THE MODEL ENGINEER

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SEPTEMBER 10th 1953
Vol. 109 No. 2729

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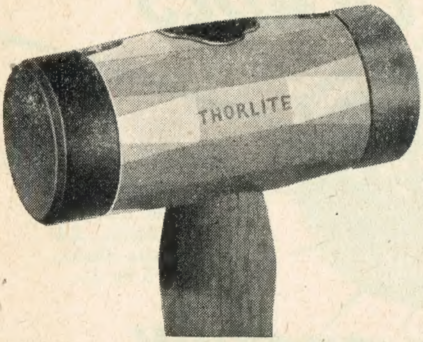

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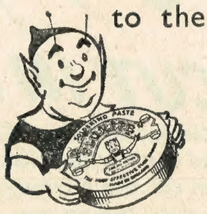

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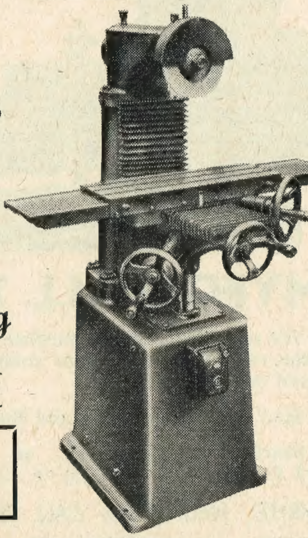

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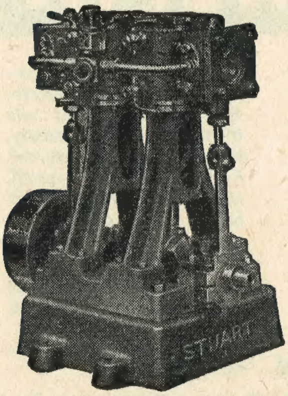

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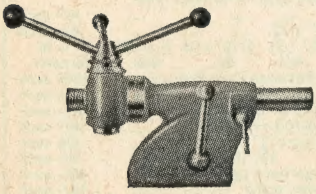

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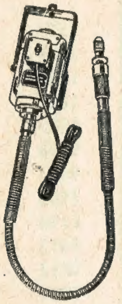

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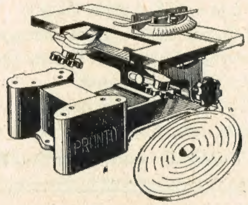

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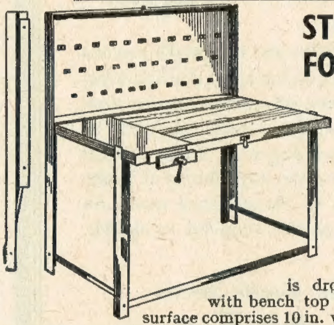

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THE MODEL ENGINEER

EVERY THURSDAY

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CONTENTS

Our Cover Picture

The demonstration tank was one of the most popular features at the "M.E." Exhibition and the demonstrations of the radio control of boats was the principal, if not the only phase of modelling shown on it. This year the reliability of the apparatus was noticeable, especially when compared with that of previous years. This is a very satisfactory state of affairs, and speaks volumes for the good work which has been done by the radio control fans during the last year. The boat shown in our photograph was built by A. J. C. Waller, of Watford, and represents the well-known Thames paddler, *Royal Eagle*. This model—which has been described and illustrated in the pages of *Model Ships and Power Boats*, is very proportionate above the waterline, and looks well in action. An unusual feature is that the passengers and crew are shown on board. This is a feature which could be copied with advantage by other builders of model ships.

SMOKE RINGS

The "Can" Man

A CLIENT recently telephoned us to seek advice on a little technical problem that was troubling him. We found it necessary to ask him a few questions as to the equipment he had available, and in the course of conversation we discovered that here was a disabled man living on a pension and unable to take any ordinary job. He just "potters about" doing odd jobs for his neighbours and himself, with the aid of a modest collection of tools, in his workshop. He told us that THE MODEL ENGINEER is his bible, and he consults it whenever he is in need of any instructive and constructive information, and he nearly always finds what he wants in our pages. This helps him to take his mind off his plight; it makes him feel that he is, as he put it, a "can" man where others are "can't" men, because he is able to do what many other men cannot do. He gets pleasure out of life, in spite of his handicaps, whereas many other men would do nothing but sit about moaning over their fate !

The moral of this is that every man should have a useful hobby to turn to when he is unable to earn his own livelihood.

A Radio Mystery

ON THE occasion of the B.B.C. feature broadcast at the "M.E." Exhibition, the staff decided to arrange a "monitor" service so that they could listen-in while the broadcast was in progress. A mains radio set was obtained and plugged in to a lampholder in the Press office, but to the consternation of all concerned, it was found quite impossible to tune in to the required programme. Strange noises emitted from the set drowning everything that might have been received over the air, and these were found to be a confused medley of *all the noises in the hall*, including those produced by the locomotives on the track, the fairground music, and the blacksmith's anvil. Time was getting short, and something had to be done, so one of the staff went off hot-foot to obtain a battery set. Returning with this in a taxi, it was tuned in as the broadcast began, and worked perfectly both there and in the Press office. We are now wondering how the sounds in the hall could have been picked up, as although there is the possibility that the speakers of the public address system might have acted as microphones and "fed back" to the amplifier (had it been turned on) the question still arises as to how it affected the receiver, presumably through the mains. No doubt many of our readers who understand the subtle mysteries of radio may find the solution quite simple, but we have never encountered anything quite like it before. Our guess, however, for what it is worth, is that some apparatus on the mains circuit must have been "miking," like the "speaking arc" which proved to be such a fascinating phenomenon in the early days of radio telegraphy. As we do not specialise in electronics, we beg any of our readers who essay to solve the mystery, not to make the explanation too involved; but we *should* like to know the real answer !

A Model Motor-Cycle Competition

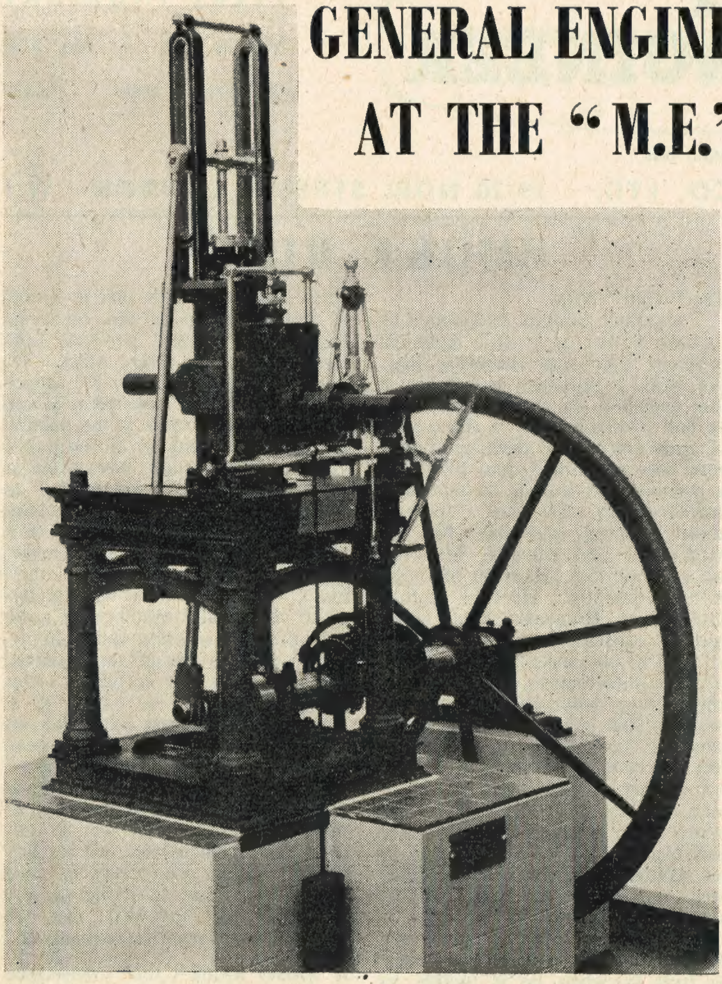
WE ARE informed by the Auto-Cycle Union that they are organising a competition for model motor-cycles. At present full particulars of the competition are not available, but it is hoped that they will be prepared in time for the Motor-Cycle Show, which will held at Earls Court from the 14th to the 21st of November.

Birmingham Tramway Enthusiasts

THE TRAMWAY and Light Railway Society is anxious to form a Tramway Modelling Group in the Birmingham area. The ultimate intention is to hold regular meetings and to construct an exhibition tramway layout; also, at some later date, a "Midlands Tramway Modelling" exhibition may be possible. Anybody interested is invited to get in touch with MR. D. F. FELTON, 177, Fieldhouse Road, South Yardley, Birmingham 25.

GENERAL ENGINEERING MODELS AT THE "M.E." EXHIBITION

Reviewed by E. T. Westbury



The 1½ in. scale Napier Table Engine by Messrs. Kent and Tapper.

THE very wide range of models embraced by this section included several which deserve special mention for fidelity and realism. Our brief review of the exhibits in previous issues can now be supplemented by further particulars obtained from actual inspection. Among the stationary and marine engines, the Napier table engine by Messrs. Kent and Tapper fully lived up to the standard set up in previous years by these constructors. The prototype of this model was constructed nearly 100 years ago, and in attempting to reproduce faithfully the appearance of such a model, the question of finish is a very important one. Some constructors, in avoiding the appearance of newness in an early type model, go to the other extreme and make the model look decrepit and shabby. It is, however, fairly certain that most old engines by reputable makers were, *at the time of their erection*, quite handsome and well finished ; and this point has been recognised by the makers of this model. Without in any way destroying the character of the engine as a "period piece," they have given it a finish which does justice to the fine detail work in the structure as well as the working parts.

The motion work of the engine embodies some very fine workmanship in the fitting of small gib and cotter joints in the connecting-rods, valve gear, etc., the octagonal main bearings fitted to the crankshaft, and the operation of the valves from a rocking shaft with a gab hook on the eccentric-rod. Throttle governing is provided by the conventional form of centrifugal governor, driven by bevel gearing from the crankshaft. Non-working parts were finished in dull black, which adequately covered but did not obscure the details

Similar attention to detail was shown in Mr. H. V. Davies' "Grasshopper" beam engine, and in the small scale adopted for this model, many of the working parts were reduced almost to "watchmaking" size. Some very neat workmanship was shown in the fabrication of the structural parts, and the brickwork of the supporting structures was very realistic in appearance.

Regarding the model roundabout by Mr. Herbert Slack, it is difficult to put one's appreciation into words without running out of superlatives. It would, however, be no overstatement to say that this is one of the finest working models that has ever appeared at any "M.E." Exhibition. Apart from the fact that in all the multitude of fine details, the most critical eye is hard put to it to find a single fault, the working realism and "atmosphere" are no less impressive. The steam engine which drives the model is by itself, a noteworthy model ; its boiler is fired by Calor gas, and the fact that it functioned perfectly throughout the period of the Exhibition is sufficient testimony to its practical merit.

Some of the smaller and simpler types of steam engines, including those of well-known standard designs, might be labelled "fair to middling"; in one or two cases there were detail errors, and imperfect workmanship. At least one of them however, deserves special mention, namely, the triple-expansion marine engine by Mr. D. W. Broughton, which was of excellent workmanship throughout, and gave a good idea of what can be accomplished with a set of commercial castings in capable hands.

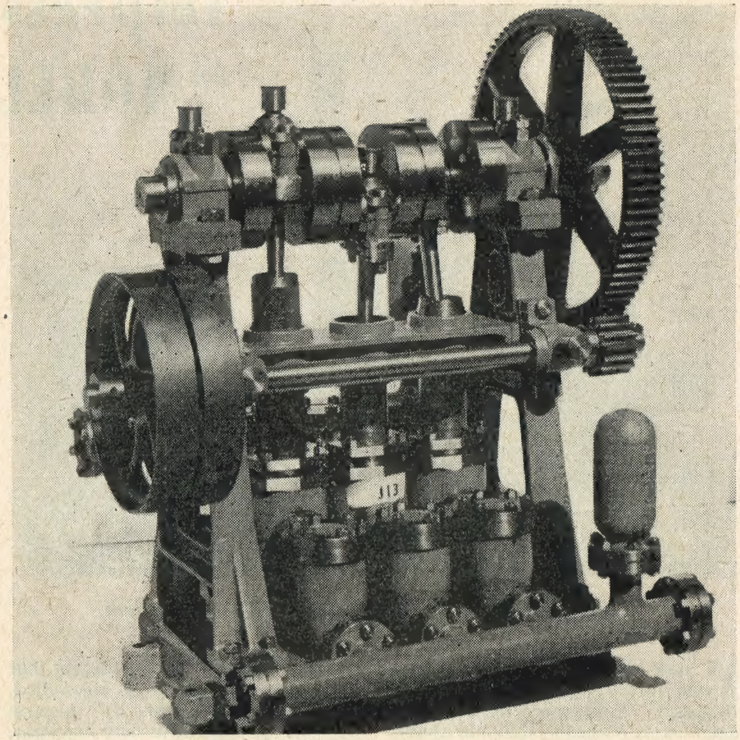
Another very attractive engine was that by Mr. S. J. Bowles, which was shown coupled to a centrifugal ventilating fan, of the type used to supply forced draught to marine and stationary boilers. The detail work on the engine was very good,

including the lubrication system with its pipework, also that of the cylinder drain cocks. Similar care was shown in the forming and riveting of the fan casing, and the fan rotor construction.

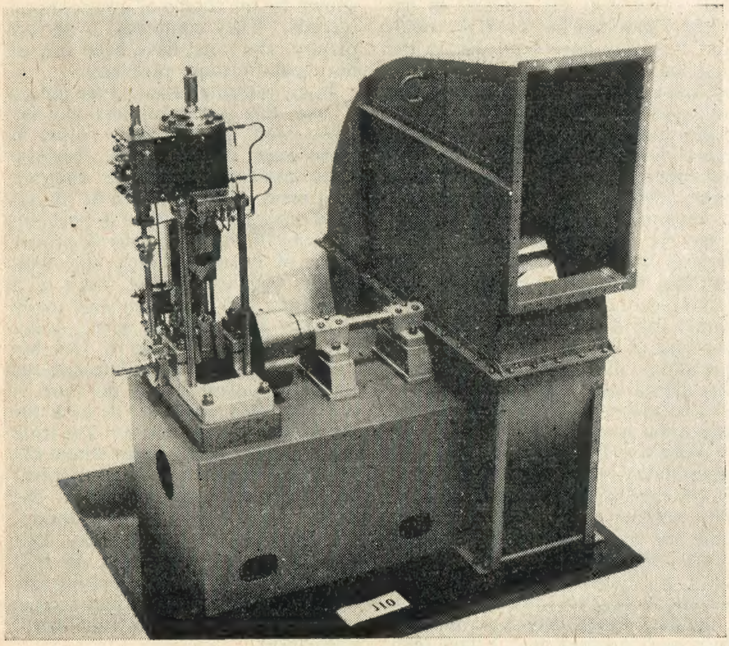
The half-size reproduction of the "Warrior" twin double-acting engine to "M.E." design gave a glimpse of the possibilities for producing a very dainty miniature, but unfortunately the constructor had not executed this idea quite so well as he might have, and one or two cheese-head screws rearing their ugly heads among the working parts shattered illusions of realism rather rudely.

A rock on which many constructors split is the interpretation of the term "free-lance," which is only too often used to describe, or perhaps to excuse, models of things that never were, nor ever could be. It may be said briefly that the only justification for the free-lance model is to exploit the best possibilities of "replica" and "experimental" types; neither errors in engineering practice nor anachronisms can be condoned.

Apart from engines, one or two other engineering models may be mentioned as being of more than passing interest. The three-throw plunger pump by Mr. J. C. Snelling was a very well-made exhibit, though it was larger than could conveniently be handled in the average model workshop. In fact, it would be quite capable of carrying out an everyday job in lifting water for domestic supply, or feeding a fairly large industrial boiler. It was apparently made to an early "M.E." design, though exact confirmation of this is not available at the moment.



Mr. J. C. Snelling's three-throw plunger pump.



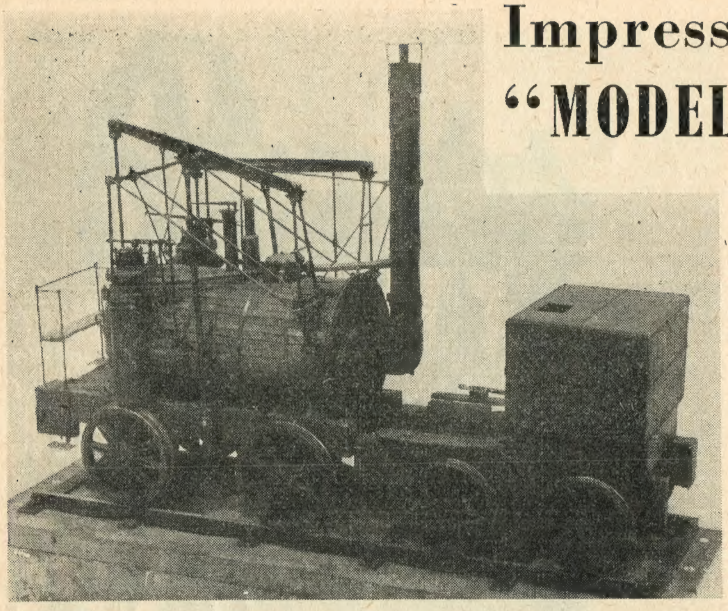
A 1 in. × 1 in. engine coupled to a centrifugal fan, by Mr. S. J. Bowles.

The 1-in. scale mole drainer by Mr. R. W. Palmer was a very interesting reproduction of a machine which, in type if not specific purpose, follows the lines of design and construction adopted in agricultural implements. It was painted in bright colours practically all over, which is quite true to type, and the methods of construction were also apparently correct. Such models are not so common as they deserve to be; a probable reason for this is that few constructors have access to information on their design. They serve a very useful purpose in calling attention to the vast amount of ingenuity which has been devoted to machines for saving labour in everyday tasks; it would be helpful if an exhibit of this kind could be accompanied by a description of its functions and working principles to assist observers to understand what it is all about.

(*Continued on page* 303)

Impressions of the "MODEL ENGINEER" EXHIBITION

By L. H. Sparey



One of the exhibits that it was almost impossible to fault

IT has always been one of the charming things about the "Model Engineer" Exhibition that, though each one is different, thay are always the same. When one first enters the exhibition hall it seems but the continuation of the pleasures of twelve months ago, with the added satisfaction of new sights to see and new things to criticise or admire. An old friend in a new suit. This cunning ability to preserve the friendly, welcoming atmosphere will, I trust, continue, and I pray that the organisers will never fall for the wiles of some slick producer who —following the modern trend—may persuade them one unfortunate year to present us with a "MODEL ENGINEER EXHIBITION ON ICE!"

This year, at least, we are safe, and we may greet in their correct environment the familiar names and faces without which we should indeed be in a strange land. Here are our old friends the lathe manufacturers, the suppliers of materials, and the venders of all those wonderful tools and gadgets that I would buy if I had the money. I am sure that the salesman must know, from the furtive way in which I avoid his eye, that I cannot possibly be a candidate for that latest milling machine, yet he behaves as if the bulge in my pocket was, in fact, pound notes instead of catalogues.

The trade stands are indeed the first things to take the eye; which is hardly surprising considering that they have been designed, bejewelled, and illuminated for just that purpose Nor do I grudge them their limelight, for without them our exhibition would not be possible. May they meet their reward from visitors more affluent than I. Yet it is, I suppose, the models that we really come to see. This year the number of exhibits was somewhat lees than usual, and this may have been due to the fact that a shorter period has elapsed between shows. Also, the number and quality of the exhibits at the last exhibition was exceptional, and it cannot be hoped that model engineers can mantain such an output year by year. Doubtless, in many secluded workshops throughout the country, there are many masterpieces slowly forging ahead towards completion, and they will be here to dazzle us on some future occasion. That is how I would like it, for I believe that the showing of a half-finished model is a mistake. Only an expert can judge the merits of an unfinished work. To the ordinary visitor it is neither one thing nor the other.

What was lacking in quantity was certainly compensated by variety, and by the excellence of most of the models displayed. The exhibit which stole the show, was of course, the steam-driven roundabout by Mr. H. Slack of Chapel-en-le-Firth. My observations may help others to clear up a mystery which may have puzzled them as it puzzled me. I have seen several model roundabouts in my time, some of them beautifully made, yet all had the appearance of painted German toys. A roundabout is just about the most difficult model to make convincing, because the protype itself is really nothing but a huge toy. As we descend in scale, the toylike qualities become more and more apparent. Why, then, is Mr. Slack's effort such a masterpiece of realism? The answer lies, I think, in the very fortunate choice of scale. Mr. Slack's roundabout is large enough to make its toylike qualities authentic. It is imposing. It is bold, It flaunts its gaudy colours and polished brass with all the brazen assurance of the real thing. This, coupled with excellent workmanship and attention to minute detail, welded together by Mr. Slack's obvious love of roundabouts which shone brightly from every pinnacle, earned him a well-deserved Championship Cup. His artistry in this field was well shown by his choice of gramophone records. They completed a perfect picture, and must have been one of his most tiresome problems.

In my capacity as one of the judges I have, this year, examined the exhibits with minute care. This, in some ways, is unfortunate, because ones impressions become clogged, as it were, with memories of roundhead screws used in place of hexagon bolts, and with doubts over the proper place of hexagon bolts, and with doubts over the correct shape of a cartwheel spoke. If you wish really to enjoy an exhibition never, under any circumstances judge it. One becomes too exacting and suspicious for full enjoyment. If no fault is obvious, then you start to look for it. And at last you find it! The little 6 B.A. screw hidden away where the couchbolt should be. Judging is bad for the model and worse for the judge. Faults may always be found, and sometimes I have qualms that I may have invented a few. Be that as it may, my judging experience has certainly coloured my impressions of this years's "Model Engineer" Exhibition.

On my sideboard at home I should like to have a glass case; and in that case I should like to have the exquisite little model of Hedley's *Puffing Billy*, made by Mr. J. S. Youngman of Chichester. I cannot remember, in a fairly long experience, having seen before a model that so perfectly conveyed the atmosphere of its time. The prototype is now about 140 years old. So is Mr. Youngman's model—not a day more nor a day less. This was one of the exhibits that it was almost impossible to fault, and the only thing that I could query was the use of wood instead of iron for the fish-bellied rails upon which the engine stood. One had the impression of a vast amount of research, and a close study of the prototype—even to accidental dents in the boiler plates—and if Mr. Youngman took his details from the exhibit in the Science Museum at South Kensington, then his visits must have been so frequent and prolonged that he must almost have become one of the permanent exhibits himself. The museum must miss him! Let us hope, however, that he will visit it a ain, and that we may at some future time see more examples of his work. There are many interesting things that would yield with equal grace to his skill. For he is an artist.

As is the wont of impressions, I find that my own will not, like the exhibition catalogue, confine itself to sections, and my mind jumps from one exhibit to another as is my fancy. Thus, with complete irrelevance, I jump to the little case of $\frac{1}{16}$th-scale models of a rifle and two shot guns, by Mr. L. E. Turnill of Bristol. This exhibit I found delightful, and, with the exception of one out-of-scale screw, faultless. In spite of their small size, I felt that they really had bagged the scale duck and pheasant shown in the same case. Both had a depressingly "shot" look about them.

In the same category I must place the case of miniature sports equipment shown by Mr. W. Lucking of Robertsbridge. I seem to remember that last year Mr. Lucking showed us a collection of cricket bats dated from 1750 onwards. This year's exhibit had no such historical interest, but was a display of modern sports impedimenta. My knowledge of sport is limited, and about 40 years out of date, and I failed to place several bats and cudgels. Yet, the gear that I recognised, such as tennis racket, hockey stick, skate, and Indian club, were beautifully portrayed.

I have at my command a whole stable of hobby horses, any of which I will mount and ride on the slightest provocation. One of my pets is the belief that it is almost the duty of modelmakers to preserve, in model form, any machine or vehicle that represents a local custom or tradition. Farm wagons are right in this category. Almost every country in England has its own peculiar type of vehicle, and I greet with pleasure any representation of them. This year there were two, the 2-in. scale Gloucestershire farm wagon by Mr. C. E. Rogers of Abergavenny, and the $\frac{1}{8}$-in. scale Oxfordshire wagon by Mr. E. J. Perkins of Aylesbury. As exhibits to be enjoyed, both were delightful, and must have given pleasure to many visitors. Looked at with the jaundiced eye of the judge both, curiously enough, fell for the

Large enough to make its toylike qualities authentic

A vehicle that represents a local custom or tradition

same reason—a bolt or two that would have scaled up to about 2 ft. in diameter. Never mind, Messrs. Rogers and Perkins, in my human moments you pleased me greatly.

An exhibit that would stand looking at, with eyes jaundiced or otherwise, was the $1\frac{1}{2}$-in. scale 6 n.h.p. Napier Table Engine, built by two modellers, Mr. A. J. Kent and Mr. F. H. Tapper of Smethwick. This is quite a remarkable piece of work, and although I cannot say which modeller built which, neither has let the other down. Two model engineers with such equal skill, and such an equal interest in the same project, must be rare indeed. Such a fortunate combination was bound to produce something good, and my expert colleagues tell me that this model is an almost perfect representation of the engine as it left the works over a century ago. Its beautiful workmanship and finish well merited the Silver Medal award. How they will share this between them I do not know. I hope they never fall out.

At this point I can feel one of my pet hobby horses nosing me urgently from the rear, and I trust that Messrs. Kent and Tapper will forgive this equine interference. It has to do with the method of representing the tiled floor upon which this fine model is mounted. For so many years have we been used to seeing this scratched-wood representation of tile and brickwork that I fear we have come to believe that it really does look like the real thing. But it doesn't. Painted wood with lines scratched upon it looks like nothing so much as painted wood with lines scratched upon it, no matter how cunningly and carefully it is executed. Real brickwork and tiling can be imitated, because I have, for an experiment, done it. My bricks were cast from plaster-of-Paris, brickdust, and red ochre. They were laid one upon the other, in English bond, with plaster-of-Paris tinged with yellow ochre for cement. It is a messy job, but you have a brick wall that Gulliver would have recognised.

An exhibit I remember because of its robust appearance and workmanlike approach was the three-throw plunger pump of Mr. Snelling of Croxley Green. Although this pump was classed as a model, I feel it could actually do a job of work in some industry or another, and could shift quite an appreciable quantity of liquid. The standard of workmanship was quite up to that which we expect to see, and the model gave indications of quite an amount of preparatory work. The patterns for the castings should be interesting. I liked this model for its straightforward, genuine presentation. No frills; just engineering.

One of the displays that I always look forward to seeing is that of the tool section, but this year I was just a little disappointed. The power hacksaw machine by Mr. Caster of Kingsbury was a workmanlike job, and not too highly finished for comfort. I hate polished nuts on a machine intended for hard use. I feel like a vandal every time I apply a spanner. I could be at ease with Mr. Caster's saw.

A 4-in. rotary machine table, from Mr. H. A. C. Hunt of Smethwick, particularly aroused my interest because I have just completed such a tool for myself. In spite of repeated warning to visitors not to touch the models, I took advantage of my "official" status to try out the action of the worm and wheel. Just a little lumpy, I thought, but the engraving and numbering of the degree markings was neater and clearer than my own. If you wish to swop tables, Mr. Hunt, contact me through the usual channels!

The dial gauge and fittings of Mr. Sales of New Malden deserve mention as a creditable attempt at a difficult subject. The action is smooth and positive, and only the hand-written dial markings distinguish it from the commercial article.

The small lathe, numbered N9 on the stand, was probably received too late for inclusion in the catalogue. This lathe was one of those puzzling exhibits which are a combination of good and bad. It is difficult to believe that a man who can put such good work into the lathe slides, could content himself with the pinch-bolt type of head bearing found only on the cheapest machines. I looked at this lathe for some time, and finally concluded that the builder had obtained one of those tiny, proprietory machines which were available before the war for a few shillings, and had added his own refinements. They are too good for the basis.

Whether the locomotives of Mr. H. E. White, on the S.M.E.E. track, are well designed is a matter for the experts. Unnoticed they certainly are not. Nor are they likely to be so, for Mr. White builds on a footage basis, with no holds barred. Thus, in his *Arthropod*, we have 6 ft. 6 in. of articulated locomotive, in 3½-in. gauge, classed, modestly enough, as a 2-6-6-4. In its way it is a remarkable engine; not the least of its virtues is its ability to negotiate successfull a 20 ft. curve. Another imposing engine is his 3½-in. gauge Garrett—a mere 4-6-6-4 with the performance of a bulldozer.

Mr. H. E. White is probably one of the most advanced and prolific builders of today, and does, I understand, produce an average of about one locomotive a year. Evidently, he produces for use and not for show, so I fear he will never win a championship cup.

Perfect Marine Models

I wish I knew more about boats. Year after year I wend my way to the boat section of the exhibition, and do a little private wondering. Here, it seems to my uninformed gaze, we meet perfection. But surely there must be a snag somewhere. In the boat section, I think, we find the extremes of modelling. A bad boat is a horror. A good boat a perpetual joy. But this year I am confounded. There is one which will fit into both catagories. It is Mr. Clayton's radio-controlled sloop, *Geebaa II*. Its finish and workmanship are beautiful; yet I cannot reconcile myself to the hull. A regular, globular, sunfish of a hull! Doubtless the needs of radio-control demand it, but I wish you had not done it, Mr. Clayton.

And then to the scale model of H.M.S. *Victory* by Mr. N. H. MacLeod, of Bognor Regis, which, to me at least, is one of those models which one sees, but does not believe. I do not know what the experts say about this ship, but if there was still room on my sideboard I would like another glass case. It seems to me that ship modellers are up against it all the time. Not even a rope or wire is standard. Everything must be made, and well made, too, for the judges are real dyed-in-the-wool experts, who would knock you down as soon as look at you. Competition ship modelling must be a hard life.

It is not often that a small, waterline ship model excites my attention, but I was caught and enraptured by Mr. E. A. Kempster's model of a Bristol Channel pilot cutter of 1890. This little model was full of movement, and I could almost hear the ropes creaking as she plunged into the waves. I hurried away, for I am not a good sailor. . .

And then it was that I saw, what was for me, one of the highlights of the show. The battery driven model of the paddle steamer, S.S. *Corona Queen*, by Mr. A. Bartlett of London, W.C.1., who is totally blind and deaf. And though I stood and looked for a full five minutes, I saw not a model paddle steamer, but only the model of a monument to human courage. And did I only fancy that the shining boats around looked just a little ashamed of themselves?

It is said that there is nothing quite so dead as a dead love; yet I lingered for a considerable time at the model aircraft stand, if not to woo again, then at least to admire the loves of my younger days. The outstanding effort in this section was the control-line PZL 37, from Mr. Z. A. Wojda of Whitchurch. This Polish, twin-engined bomber was most excellently made and finished, with a feeling for realism, and a multiplicity of working parts, not often found in model aircraft. I understand that the machine was finished only just in time for the show, and that it has not yet been ventured into the air. Judged by all standards, there seems to be no reason why its performance should not match its looks, and I should like to see the undercarriage retracting as the machine rises in flight, and lowering as it comes in to land.

So back to the trade stands. To the lathes of Myford, the tools of Buck and Ryan, the taps and dies of Kennion, the castings of Dicky Simmonds, and the ingenuities of Cowell.

But this, I think, is where we came in.

GENERAL ENGINEERING MODELS

(*Continued from page* 299)

Internal combustion engines at the Exhibition are generally dealt with in a special article, but on this occasion only one exhibit in this class was shown in the competition section, namely, the 1-in. scale horizontal engine by Mr. H. Dewhirst. This was a very well made model, true to type in general proportions, and only modified in detail as required to make it successful as a working model, running on liquid fuel. It is worthy of note that the skew gearing driving the camshaft had the teeth filed by hand, and the fact that it worked smoothly was a testimony to the skill of the constructor. There appears to be no question of the merit of the engine as a working proposition, but as a realistic model of a full-size engine, it suffered from one or two inaccuracies in the setting, such as its mounting on a polished wood base, and the use of copper tubing for water circulation pipes. Constructors of any type of model which is capable of useful work should always face up squarely to the question of whether it is to be regarded purely and simply as a "utility" working model, or a reasonably accurate representation of a full-size engine. In the latter case, the correctness of the setting is as important as that of the engine itself.

Little else in the way of internal combustion engines was discovered either in the competition or trade sections of the exhibition, and this is much to be deplored, as these engines have played a very important part in the development of all types of models, and have often featured among the most interesting exhibits.

Very often some noteworthy examples of i.c. engines are found in the model power boat section, but this year, most exhibits of this type were fitted with commercially-made compression-ignition engines, with or without more or less extensive additions or modifications such as water cooling, silencers, etc. While it is without question that the modern commercially-produced engine serves a very useful purpose, and has put a highly-efficient means of propulsion into the hands of model boat, car and aircraft constructors, it would indeed be a tragedy if it destroyed enterprise in the construction of engines by amateurs. There is plenty of information available on this subject, and amateurs have proved quite capable of using it to advantage in the past. The examples installed in boats on the Model Power Boat Association stand, some of which have achieved notable performance, give proof of their possibilities, and may well be emulated by future constructors.

MORE UTILITY STEAM ENGINES

By Edgar T. Westbury

THE piston and piston-rod for the "Unicorn" engine are shown here as a complete assembly, as the essential thing in their construction is that the two items should be exactly concentric with each other. Various means are employed to ensure this; in full-size engines, the most common arrangement is to employ a taper fitted rod with a nut on the end to draw it up tightly and make it secure. This method is, of course, equally suitable for models of any size, but a parallel fit is simpler, and has been found quite effective. Some of the methods which have been used in models, however, have introduced liability to error; in many cases, there has been a tendency to over-simplification, in the effort to avoid at all costs the need to machine the rod.

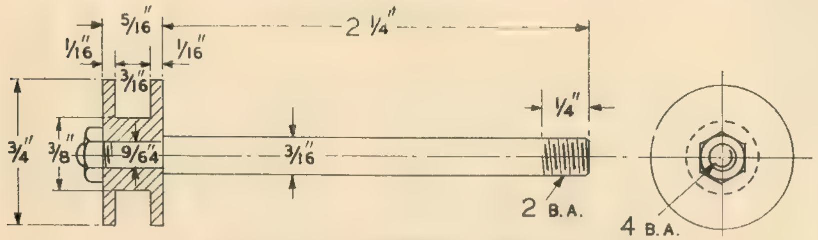
The method shown here enables the rod to be made from bright rolled steel bar, with no machining of the main working surface, provided that it can be set up truly for turning down the end to receive the piston-head, and also for screwing the other end with the aid of a tailstock die-holder. If a collet chuck of *proved* accuracy is available, this presents no difficulty at all; but there are other methods available to those not so well equipped, such as the use of a thin bush, bored out *in situ* to take the rod, which is then held by further tightening of the chuck jaws. Or the four-jaw chuck can be used, and truth of the work ensured with the aid of a simple test indicator. These methods may seem a little tedious, but they are well worth while if one wishes to be certain of accurate results.

There is, however, yet another method of producing the component which is equally effective; that is, to make both the rod and the piston head oversize, and *permanently* assemble them by pressing in or even sweating, the securing nut being fitted equally tightly. The assembly may then be turned all over between centres, including the shank of the rod; and, provided only that the live centre of the lathe runs truly, the concentric accuracy of all surfaces will obviously be beyond suspicion.

The piston is shown with a wide and deep groove to take graphited asbestos packing, which is perhaps the best all-round method of preventing leakage in small steam engines, but if desired, it may be arranged to take a couple of piston rings, or even be made a precision-lapped fit so that no packing is needed at all. Except in the latter case, it should have about 0.001 in. clearance in the cylinder—in more homely terms, a smooth push fit. The material specified will be satisfactory, but stainless-steel would be better still.

As there may be some chance of cumulative error in the dimensions of various engine components, it is advisable to allow a little extra length on the piston-rod to ensure that it can be fully screwed home in the crosshead, with the clearance correctly adjusted to 1/32 in. at each end of the stroke. This location adjustment cannot, of course be made until the working parts are fully assembled.

Full-size engines often have taper-fitted piston-rods at the crosshead end also, and in the type of engine which this represents, the rod was usually drawn in and secured by a flat tapered cotter. This would be a rather difficult item to fit to so small a rod, and the common alternative of a small round cross-pin, often seen in models, is not mechanically sound, especially if it is applied to a plain parallel-fitted rod. It is, however, permissible to cross-pin a screwed rod for extra security, so long as the thread is a good fit and the rod screwed well home.



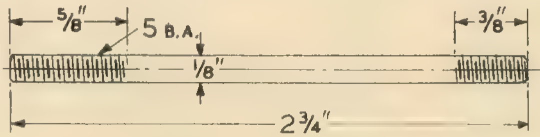
PISTON & ROD ASSEMBLY 1 OFF M.S

CHECK & ADJUST LENGTH OF RODS ON ASSEMBLY

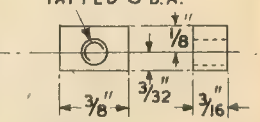
Valve-rod and Nut

The rod is made from ⅛ in. dia. bright mild-steel, which must, of course, be dead straight and true, and this applies also to the screwed ends, so that the rod should be set up truly for screwing these with a tailstock die-holder; either 5 B.A. or ⅛-in. Whitworth thread is suitable. The valve nut should preferably be made thicker than shown here, and skimmed up on the sides to fit the slot of the slide-valve neatly, by mounting it on a screwed pin held in the chuck.

It may here be observed that this method of driving the slide-valve, while simple and convenient, and leaving the valve free to find its own seating, has one serious shortcoming, in that it does not provide a means of fine adjustment for the valve setting. If the rod is screwed to the same pitch at each end, its rotation relative to the nut will not



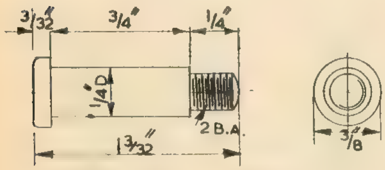
VALVE-ROD 1 OFF M.S.



VALVE NUT 1 OFF BRASS

Continued from page 265, *August* 27, 1953.

affect adjustment, as it will screw in and out of the knuckle joint to the same extent. If it were possible to use threads of different pitches at the two ends, this would provide a means of *differential* fine adjustment; but the only available standard threads in this size—namely Whitworth and B.A.—have a difference of only approximately three threads per in., which is too fine to be really useful, as it would provide less than 0.002 in. movement for one complete turn of the rod. In most small steam engines, the only possible increments of movements



WRIST PIN 1 OFF M.S.

are half-turns of the knuckle joint, which in this case amount to 0.0125 in.; in cases where the knuckle is offset, a complete turn must be made, which is worse still. This presents a rather interesting problem, which must have been noticed by hundreds of model steam engine constructors; but strangely enough, I do not recollect having seen it referred to in print before.

One solution of the problem would be to use a right-hand thread on one end of the valve-rod, and a left-hand thread on the other, thus enabling any desired adjustment to be obtained by slackening the lock-nut and rotating the rod. Means for doing so could be provided by sweating or otherwise securing an extra nut on the rod, clear of the lock-nut, and this would undoubtedly facilitate really accurate valve setting.

Knuckle Joint

A piece of $\frac{5}{16}$ in. square steel bar is convenient for making the knuckle, but if this is not available, round material may be used, and it can be squared up by milling or filing before parting off from the bar. It is best to work with the fork end outwards, as the tapping hole for the valve-rod can be drilled through from this end, and counterbored to about 11/64 in. diameter to remove a good deal of the unwanted metal from the fork. The circular boss at the back of the fork may be turned, but before parting off, the work should be removed from the chuck and held, either in the toolpost or some other convenient fitting, at right-angles to the lathe axis, for slotting out the fork and also, if necessary, milling the outside surfaces as well. This is not necessary when square material is used, but if so, take care to see that this is mounted so that the sides are truly horizontal and vertical to ensure that the fork is accurately slotted.

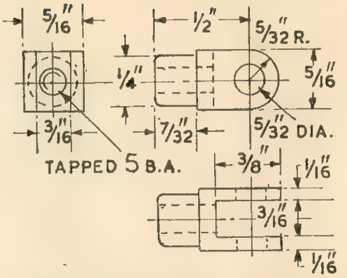
Milling

It is also convenient to drill and ream the cross-hole, again with due care to preserve accuracy, before parting off; the hole may then be used to mount the work on a pin mandrel for milling the rounded end of the fork. The length of material which has been used for chucking serves as a lever to enable this operation to be properly controlled. (See the " M.E." handbook *Milling in the Lathe* for details of operations of this nature). Finally, the fork is parted off, and if a sharp tool is used, no further work on it will be necessary except deburring of the thread with a countersink or centre-drill, which may be done by hand.

The crosshead wrist-pin and the valve knuckle pin are straightforward jobs which can be machined all over at one setting in the chuck, being identical in everything except dimensions. They should be fitted definitely on the tight side in each case, as it is much easier to lap a little off them on final assembly than to rectify a sloppy fit !

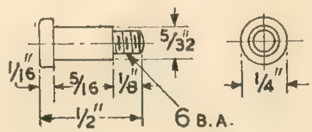
Governor Gear

Some constructors may be quite satisfied to build an engine which works, without adding any means



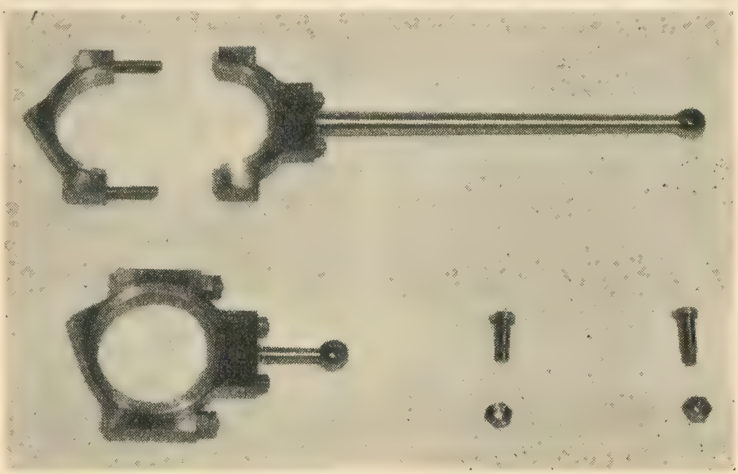
VALVE ROD KNUCKLE 1 OFF M.S.

of control ; but to those who place any value at all on fidelity, I would say most emphatically that no *stationary* engine can be regarded as complete without some form of automatic governor. It is obvious that an engine which had to work continuously for hours on end in a mill or factory would be left to its own devices for most of the time,

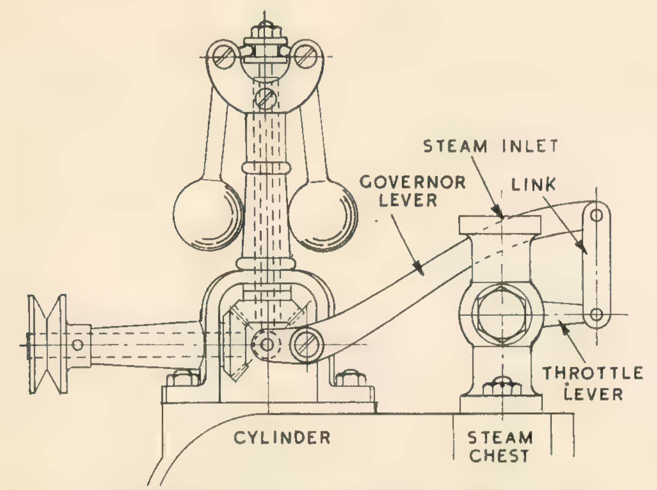


KNUCKLE PIN 1 OFF M.S.

as it would not be an economic proposition to keep one man stationed at the throttle valve the whole time. In view of the chances of load changes, sometimes unexpected, an ungoverned engine would be dangerous; in fact, although the reliability of the governor mecha-



Eccentric straps and rods for valve gear and feed pump, respectively



ARRANGEMENT OF GOVERNOR & THROTTLE VALVE VIEWED FROM CYLINDER-HEAD

nism itself is usually beyond reproach, the common method of driving it by belt is open to criticism, because of the risk that the belt may break or slip off. I know personally of a fatal accident that occurred when the flywheel of a threshing engine burst as a result of a broken governor belt. However, it is not for us to criticise this detail, as it was considered reliable enough to be practically universal in engines of the period of the prototype on which this model is based.

I have seen many models which are fitted with governors built strictly to scale, but which are to all intents and purposes, dummies, as they cannot be made effective in controlling the engine. Gravity and centrifugal force, unfortunately, cannot be induced to conform to the requirements of true scale models. In the construction of this engine, however, I was determined to produce a *working* governor, and thus although it has been made to resemble as closely as possible in proportions and arrangement, that fitted to the full-size engine, it is modified, and also simplified, in detail. Quite apart from getting the governor to work, there were some problems in the machining and fitting of the essential parts, and I have attempted to steer a middle course between fragility and clumsiness in these items.

I find that some readers are not quite clear as to how a governor works, to judge by the many enquiries encountered on this subject, and a few words of explanation thereon will not, I hope, be grudged by those who are better acquainted with elementary principles of mechanics. There are many types of engine governors, but by far the majority of them employ basically the property of centrifugal force produced by rotating masses, on the principle first employed by that versatile genius James Watt.

To expound fully the laws relating to centrifugal force would take up a good deal of space, but it is not really necessary to do so here, as I propose to deal only with basic principles. Everyone knows that if a weight is swung round in a circular orbit, there is a tendency for it to fly off into space; the heavier the weight, and the faster it rotates, the more pronounced will be the effect. It is this property which is utilised in separating cream from milk, and making cast cylinders of specially close grain; also, which causes a locomotive to leave the rails if it traverses a tight bend at excessive speed, and causes a pilot of an aircraft to " black out " on a very rapid turn, by interference with normal blood circulation to the brain. In the simple type of governor, the centrifugal force in two or more weights, so mounted as to have a certain latitude of radial movement, is utilised to operate a steam valve or some other device to control the speed of the engine.

The governor weights, which may be spherical or any other shape, are swung from a yoke on a shaft which rotates at a speed proportional to that of the engine—usually faster, in order to increase its effect—and when at rest, they lie fairly close to the shaft, so that initial rotation is confined to a small orbit. But as the speed of the shaft increases, there is a tendency for the weights to fly out away from the shaft, and this movement is utilised, through suitable linkage, to operate the control gear. In most of the conventional types of engine governors, the shaft is vertical and gravity is relied upon to restore the weights to their original position when speed is reduced. Various linkages and other devices are employed to facilitate close speed control by making the controlling force operate in proportion to the speed variation. Modern types of governors often incorporate springs to restore the weights, and may then be arranged either vertically or horizontally, but in all cases the basic principles remain.

In the particular type of governor shown here, the weights have short bell cranks at the upper end, engaging between the cheeks of a collar attached to a push-rod which passes right through the vertical shaft. Outward movement of the weights depresses the push-rod and conveys movement to a lever which is linked to the lever of the throttle-valve. This type of governor is simple, with a minimum of working parts such as pivots or links, and can, therefore, be made to operate with the minimum friction—a very desirable thing in a small engine, in which complication of parts inevitably produces mechanical inefficiency, however well they are made.

Throttle Valve

In this engine, the simplest possible means of actual control is employed—namely, a form of plug cock by means of which the supply of steam can be restricted; I will not say " cut off," as it is not necessary for the cock to be steam-tight when in the closed position. Even if no governor is fitted, a cock of this type is useful for manual control of the engine; although it is coarser in action than a screw-down valve, it operates quicker, and is often preferred.

I propose to deal with the construction of the throttle before dealing with the more intricate details of the governor. The body may be made from a casting, or machined from the solid; in the latter case,

(*Continued on page* 309)

Model Power Boat News

BY MERIDIAN

BEDFORD AND SOUTH LONDON REGATTAS

DUE to the weed situation at the Longholme lake, the Bedford M.E.S. were unable to use this water for the annual regatta. With the assistance of the Wicksteed club, however, the event was successfully held at Wicksteed Park, Kettering.

The increased travelling distance reduced the London attendance a little, but the regatta was well supported by numerous entries.

The opening event was a Steering competition over a course of about 50 yd., and the scoring was quite good. Luckily a strong breeze was blowing down the course, and not across it—the usual case in steering events.

A. Evans (Victoria), with *Moiety*, was the winner, with 13 points, closely followed by R. Mapplebeck (St. Albans), with his launch *Gisela*, scoring 11 points. Other high scores were made by Messrs. S. Fear (Cheltenham), J. B. Skingley, and J. Innocent (Victoria).

In the Nomination event, first place went to a launch entered by J. B. Skingley, but run by J. Skingley Junr. This boat completed the course with an error of only 0.6 sec. from the nominated time.

The Class "B" speed event proved interesting, although the entry was somewhat small. The ace was won by G. Lines, with *Sparky* 3, W. Churcher (Coventry), being second with *Annette* 3, and F. Jutton third, with *Vesta III*. The latter boat, which has been suffering from the cooling-off trouble that is common among flash steamers, this time succeeded in completing the course on both attempts, and indeed showed signs of speeding up after 5 laps had been recorded. It is to be hoped that this fine boat—one of the few representatives of flash steam still with us—will recover the magnificent form of previous seasons, when it was the holder of the Class "B" record.

In Class "A," W. Brightwell's four-stroke engined craft again put up a fine performance, this time recording 63.13 m.p.h. to take first place.

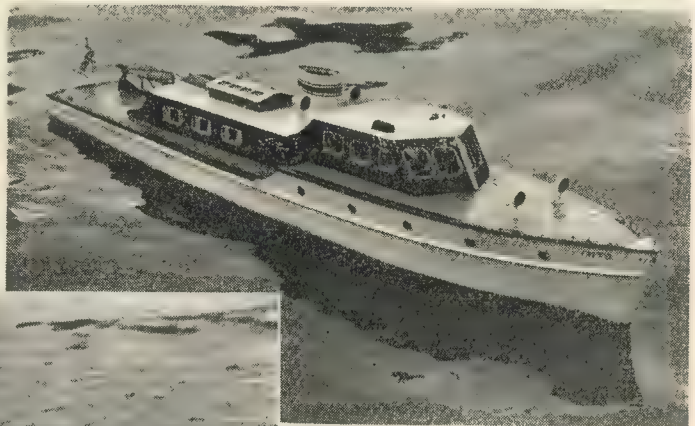
Results

Steering Competition

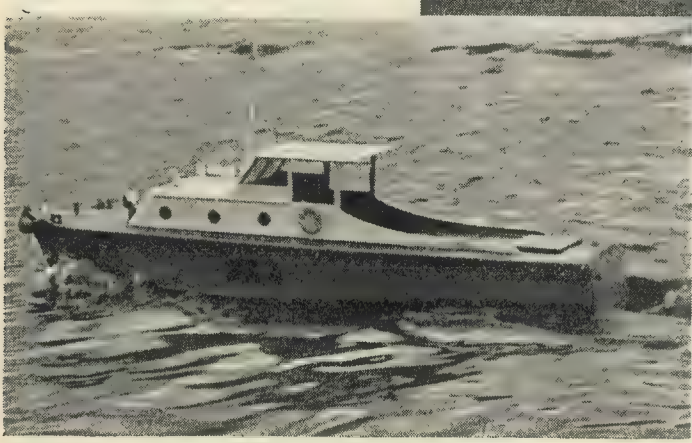
(1) A. Evans (Victoria), *Moiety*: 13 points.

(2) R. Mappelbeck (St. Albans), *Gisela*: 11 points.

(3) S. Fear (Cheltenham), *Gyppo*: 9 points.



A fine new steamer, " Gyppo, by Mr. S. Fear, of the Cheltenham club.



(*Left*)—*Mr. R. Mapplebeck's new petrol-driven cruiser " Gisela,"* (*St. Albans*); *both seen at the Bedford Regatta*

500 *yd. Class " B " Race*

(1) G. Lines (Orpington), *Sparky* 3: 51.4 m.p.h.

(2) W. Churcher (Coventry), *Annette* 3: 39.34 m.p.h.

(3) F. Jutton (Guildford), *Vesta III*: 36.4 m.p.h.

Nomination Race 50 *yd.*

(1) J. Skingley (Victoria), *Vixen*: 1.25 per cent. error.

(2) A. Evans (Victoria), *Moiety*: 2.58 per cent. error.

(*Above*). *Mr. W. Brightwell* (*Wicksteed*) *starting his " A " class boat at the Bedford Regatta*

(3) R. Mapplebeck (St. Albans), *Gisela*: 5.00 per cent. error.

500 *yd. Class " C " Race*

(1) C. Stanworth (Bournville), *Mephisto* 4: 45.66 m.p.h.

(2) E. Woodley (Victoria), *Kathleen*: 34.55 m.p.h.

500 *yd. " C " Restricted Race*

(1) W. Everitt (Victoria), *Nan* 2: 58.11 m.p.h.

(2) K. Hyder (St. Albans), *Slipper* 4: 56.82 m.p.h.

500 *yd. Class " A " Race*

(1) W. Brightwell (Wicksteed), *W*14: 63.13 m.p.h.

(2) J. H. Benson (Blackheath), *Orthon*: 60.51 m.p.h.

(3) N. Fort (Victoria), ——: 51.14 m.p.h.

S. London Regatta

The South London M.E.S. Regatta held recently at Brockwell Park, provided much interest and excitement for model speed boat fans. Due to the perfect conditions obtaining, some very high speeds were attained, and three new records were set up in the course of the 2,000 yd. " Daisy Rowland " race. These records are, of course, subject to official confirmation.

The good conditions were due partly to the fine weather, and partly to the fact that the water level had been lowered rather more than is usual. The gentle shelving banks thus exposed at the water's edge prevented backwash from boats running on the circular course.

With these conditions, speeds were high in all the racing events, although no new records were set up over the 500 yd. Here are details of the new 1,800 yd (or over) records: Class " C " Restricted: W. Everitt, *Nan* 2, 72.02 m.p.h. Class " C ": B. Miles, *Dragonfly* 3, 55.58 m.p.h. Class " A ": J. Ward, *Dina*, 56.82 m.p.h. Not all of the speed craft entered for the 2,000 yd race, as some simply have not large enough fuel tanks !

In the straight running events, over 20 boats were entered, and some keen competition ensued among the steering exponents, running over a longish course. B. Squires (Kingsmere) with the steam launch *Comet III*, was the winner, with 11 points, and a tie for second place between F. Curtis (Kingsmere) and A. Clay (Blackheath) resulted in a win for the former.

(*Below*). *Mr. W. Everitt* (*Victoria*) *with his Class " C " (R.) boat " Nan 2 "*

Results

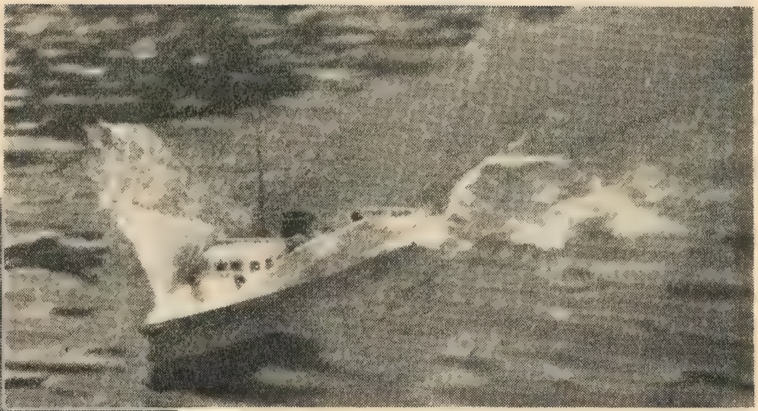
500 *yd. Class* " *C* " *Race*

(1) B. Miles (Kingsmere) *Dragonfly* 3: 61.99 m.p.h.

(2) C. Stanworth (Bournville), *Mephisto* 4: 51.65 m.p.h.

500 *yd.* " *C* " *Restricted Race*

(1) W. Everitt (Victoria), *Nan* 2: 65.99 m.p.h.



Mr. B. Squire's " *Comet III* " (*Kingsmere*) *stirring up the water in the Brockwell Park pond in the South London M.E.S. Steering Competition*

(*Left*)—" *Annette* 3 " *by Mr. W. Churcher* (*Coventry*) *showing off her paces in the* " *B* " *class event at the Bedford Regatta*

(2) K. Hyder (St. Albans), *Slipper* 4: 65.56 m.p.h.

500 *yd. Class* " *B* " *Race*

(1) G. Lines (Orpington), *Sparky* 3: 54.11 m.p.h.

(*Only one finished*)

500 *yd. Class* " *A* " *Race*

(1) J. H. Benson (Blackheath), *Orthon*: 62.36 m.p.h.

(2) N. Hodges (Orpington), *Rita*: 61.61 m.p.h.

(3) J. Ward (Orpington), *Dina*: 58.44 m.p.h.

2,000 *yd.* " *Daisy Rowland Trophy* " (*All-comers*)

(1) W. Everitt (Victoria), *Nan* 2: 72.02 m.p.h.

(2) W. Everitt (Victoria), *Nan* 3: 65.35 m.p.h.

(3) J. Ward (Orpington), *Dina*: 56.82 m.p.h.

Nomination Race

(1) J. King (Welling), *Jean*: Error 0.5 sec.

(2) S. Holmes (Blackheath), *BH*18: Error 0.52 sec.

(3) J. Innocent (Victoria), *Betsy*: Error 1.00 sec.

Steering Competition

(1) B. Squires (Kingsmere), *Comet III*:11 points.

(2) F. Curtis (Kingsmere), *Korongo*: 9 points + 1.

(3) A. Clay (Blackheath), *Elizabeth*: 9 points + 0.

MORE UTILITY STEAM ENGINES

(*Continued from page* 306)

however, it may be found difficult to make a neat job of the centre portion, which is part-spherical, unless the bosses at front and rear are brazed in after machining. In my engine, I simplified matters by making the centre square in section, by milling flats on the two sides; while this is not correct (as no maker of full-size engines would waste metal by leaving this part square unless the corners were needed to form bolting lugs), it does not look unsightly and would, I think, be excused in a working model.

It will be seen that both the entry and discharge passages are tapered, the object being to make the best possible use of the passage through the plug, which must necessarily be small. It would be very undesirable to use a large diameter plug, because of the extra friction which would be entailed in moving it. If, however, a large cross hole is drilled in a small diameter plug, an excessive angle of movement will be required to reduce the aperture to regulate the flow of steam. Hence the reason for the double-tapered passage which acts as a Venturi tube and does not restrict the full-bore flow as much as might be expected. Some readers may not believe that it is possible to run an engine of this size on the steam which can pass through an orifice not more than $\frac{1}{16}$ in. diameter; but results speak for themselves, and I assure them that it can and does run, even with quite a fair load applied at the main shaft.

The tapered holes can be formed with a simple D-bit, which should have an included angle of about 15 deg.; but it is not desirable to drill this hole right through until after the cross bore to take the plug has been formed. This may, with advantage, be made the first operation, a 3/32-in. hole being first drilled right through, and counter-bored to 5/32 in. to 13/32 in. depth (from the finished face) with a flat-ended cutter, the mouth of the hole then being tapped $\frac{3}{16}$ in. × 40 t.p.i. for the cap. After tapping, run the cutter in a second time to make sure that no burrs are left to prevent the plug going in properly.

(*To be continued*)

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Simple Refrigerators

I have seen illustrations and advertisements of a simple type of refrigerator which works without the use of a compressor or the application of gas or electricity. I understand that these employ earthenware or similar material which is kept saturated with water. Is this correct, and can you please give me details of construction and the means of possible suppliers of any special material required?

R.F.M. (Swindon).

The refrigerators of the type you mention, work, as you surmise, on the evaporation principle, utilising a porous material, kept saturated with water which is carried to all parts of the surface by capilliary attraction and evaporated by external air currents.

We regret that we cannot give you exact details of construction and materials required, neither can we inform you of anyone who can supply material for the construction of such refrigerators.

Clock Making Materials

I am interested in clock making, and should be glad if you would advise me where I can obtain tools for this work; also, finished wheels, arbors and other essential components. Can you refer me to any back numbers of THE MODEL ENGINEER *with articles on clock making?*

C.H.H. (Stoke-u-Ham).

We suggest that you may be able to obtain tools and materials for clock making from one of the following firms: E. Gray & Son, Ltd., Clerkenwell Road, E.C.1., John Morris Ltd., 64, Clerkenwell Road, London, E.C.1. and J. Dilger, 72, Clerkenwell Road, London, E.C.1.

We have published quite a number of articles on clock making at various times. One of the latest is that by Mr. C. B. Reeve entitled "An Original Long-Case Clock," which appeared in the issue of THE MODEL ENGINEER dated April 9th, 1953.

The "M.E." Cine Projector

I would be greatly obliged if you could give me information as to where I can obtain details of the "M.E." Projector.

V.L.M. (Chislehurst).

Castings, also fully detailed drawings for the "M.E." projector can be obtained from Roox Products, Wellhouse Road, Beech, Alton, Hants.

Cutting Lubricant

Can you please inform me of the address of the manufacturers of "Cutmax" cutting oil? I have tried unsuccessfully to obtain this locally, but my supplier tells me he can obtain it if I can inform him of the makers.

G.F.R. (Rochester).

"Cutmax" Cutting Oil is manufactured by Edgard Vaughan & Co. Ltd., Legge Street, Birmingham.

Camshaft for "Seagull" Engine

I am endeavouring to build the "Seagull" 10 c.c. twin engine and have now arrived at the stage of attempting to make the camshaft. As I am a complete novice and have not the first idea on how to form the cams, I should be pleased if you would advise me in what issues of THE MODEL ENGINEER *the "Seal" camshaft was described.*

I have been informed that silver-steel would be a better material than mild-steel for a camshaft. Is this correct?

C.C. (St. Leonards-on-Sea).

The article on the construction of the "Seal" camshaft appeared in the issue of THE MODEL ENGINEER dated May 15th, 1947. The methods employed in this case are directly applicable for the camshaft for the "Seagull" engine except that the number and arrangement of the cams are different.

With reference to the use of silver-steel for making this camshaft, we do not advise it, as it is much harder to machine than mild-steel, and is very little superior to it in the soft state, while if it is hardened it is liable to distort and also to become brittle. A tough alloy-steel, such as a medium nickel or nickel chrome would, however, be better than mild-steel.

Circular Saw Speed

I am making a saw bench (saw 8 in. diameter) and would like to know the speed at which it should operate for cutting wood up to 1 in. thick. Could you please advise me also regarding the h.p. of motor, and pulley sizes for saw and motor.

F.T. (Croydon).

The peripheral speed of a circular saw should be 9,500 ft. per min., and the formula for finding the r.p.m. of a saw of given diameter is:

$$\frac{\textit{Peripheral speed}}{\textit{Diameter of saw} \times 3\ 1/7}$$

In your case, therefore, the calculation is:

$$\frac{9{,}500 \times 12}{8 \times 3\ 1/7} = \text{approx. } 4{,}500 \text{ r.p.m.}$$

You will need a $\frac{1}{2}$ h.p., or $\frac{3}{4}$ h.p. motor for preference, to drive an 8 in. diameter saw. The formula for establishing the motor pulley size is:

$$\frac{\textit{R.P.M. of saw} \times \textit{dia. of saw pulley}}{\textit{R.P.M. of motor}}$$

Assuming you use a 3 in. diameter pulley for the saw, and the r.p.m. of motor is 1,450, the calculation will be:

$$\frac{4{,}500 \times 3}{1{,}450} = \text{9 in. or 10 in. dia. motor pulley.}$$

Engine for Cabin Cruiser

I wish to build a model petrol engine to drive a 4 ft cabin cruiser, and among the designs in THE MODEL ENGINEER *plans list, I notice that there are several engines of 15 c.c. available, which appear to be suitable. As I have no previous experience, will you inform me which of these will be the simplest to construct, and whether it will be necessary for the engine to be water-cooled.*

K.W. (Dartford).

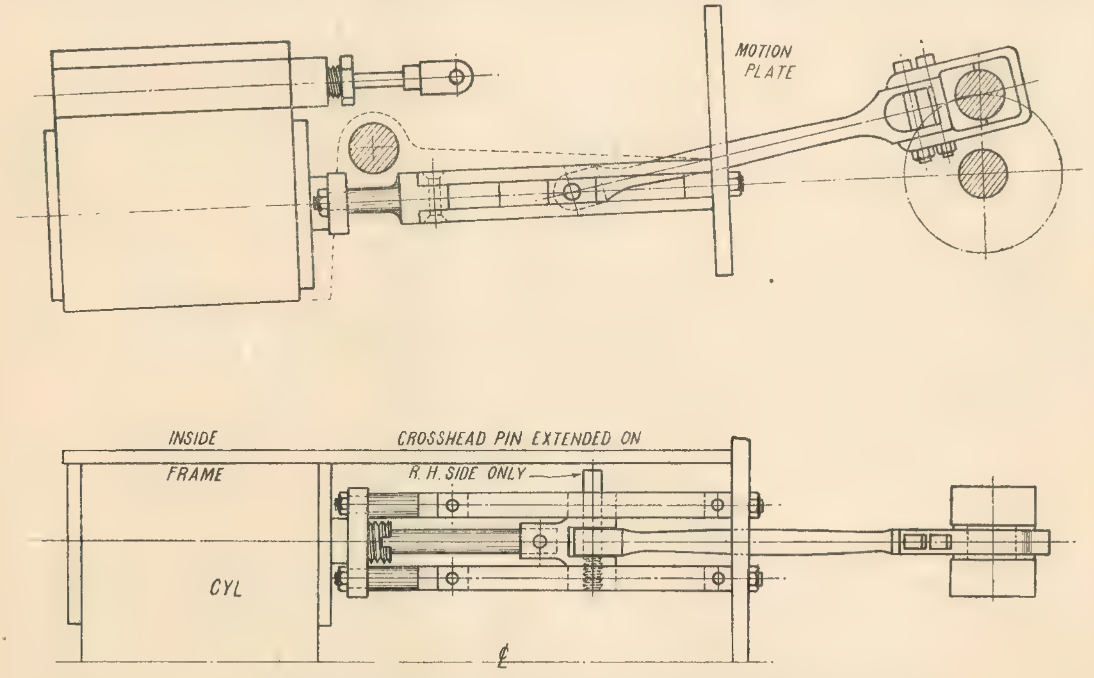
A two-stroke engine, such as the "Phoenix," involves the minimum amount of machining and fitting work, and this engine has proved quite satisfactory for the purpose mentioned, and also for construction with limited experience. If a quieter and more flexible engine is required, however, we recommend the "Kiwi" or "Kittiwake" engines, which have also been extensively used for boat propulsion. Water-cooling is generally preferred for engines in cruising boats.

L.B.S.C.'s Titfield Thunderbolt

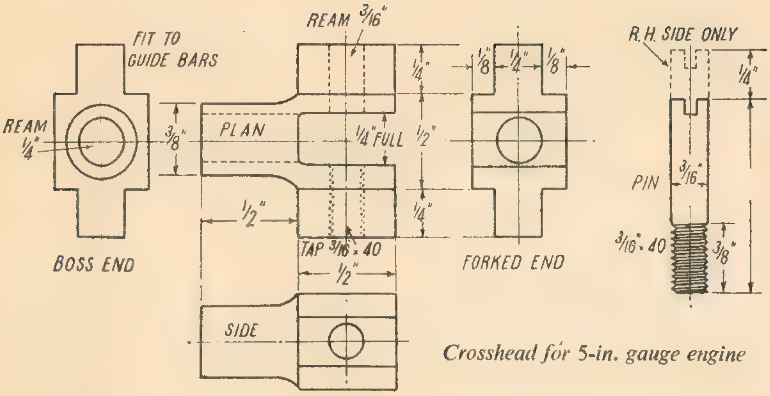
IN 3½ AND 5 INCH GAUGES

NOW we come to some real old-fashioned bits, and once more I'll try to keep my specification as near to the full-size engine as is possible, without sacrificing efficiency. On not-so-big sister, the crosshead guides were plain rectangular bars, each pair being attached to the cylinder flanges by a separate support, and at the outer ends by attachment to a spacer block riveted to the motion plate. The same kind of support will be O.K. for the small engine, and can be attached in the same way; the bars may be riveted or bolted to it as desired. The block at the outer end is also used, but has a similar spigot to that at the cylinder end, which goes through a hole in the motion-plate, and is secured by a nut. According to the drawings which were kindly sent to me by Mr. Riddles, the crossheads were plain forks with a flanged slide-block at each side, running on pins in the crosshead fork; one end of the outer pin, was prolonged to drive the crosshead pump. The crossheads were cottered to the piston-rods in the usual manner. On the little engines, there will be no need for separate slide blocks; I didn't use them on *Jeanie Deans*, which has a similar four-bar arrangement. Her crossheads are extended at each side, the extensions being machined to form tongues which slide between the guide bars, and do their job O.K. so I am specifying a similar arrangement here. Their appearance is correct, and they are much easier to make and fit, than separate blocks.

The connecting-rods are proper museum pieces. In full-size, the little ends were made in the same way as the ends of the coupling-rods. The big-end was of the strapped pattern, the strap holding a pair of flanged brasses to the end of the rod, and it was fixed according to old-time mill-engine practice; the end of the connecting-rod, and the strap, were slotted, and in the slot were two stepped flat cotters with a wedge-shaped adjusting bolt between them. The bottom end of the bolt was thinned down and screwed like the end of a cock plug; the screwed part passed through the arm of a bracket attached to the bottom of the strap, and was secured by locknuts above and below. Whilst this arrangement *could* have been reproduced in the small size, it would have been useless for serious work, as the threaded part of the bolt, even on the 5-in. gauge engine, would have only been $\frac{1}{16}$ in. diameter, and the bracket far too fragile to last the proverbial five



Arrangement of guide bars, crossheads and connecting-rods



Crosshead for 5-in. gauge engine

minutes; so I have compromised, and substituted two round bolts for the cotters. These go through plain drilled holes in the strap and end of rod, and are nutted underneath; the heads of the bolts can be filed to simulate the cotters, and so should please all the friends and relations of Inspector Meticulous. I have, however, copied the antiquated big-end, as you can see by the drawing, also the shape of the rod; this was too good to miss! They ought to look really smashing, under the boiler. The full-size rods were smaller, proportionately of course, in diameter, and truly circular in section, for their full length; but if made thus, would be rather on the fragile side for our requirements. I have, therefore, increased the vertical section, leaving the sides slightly flattened in the middle; this retains the ancient appearance, but it makes the job much stronger. Curly-designed locomotives are not intended to repose in showcases, nor even on exhibition stands, but to earn their living as all self-respecting locomotives should, doing hard work on the line! I have also shown a plain bushed little-end; but anybody who so desires, can easily ornament it with the same kind of dummy cotters, as shown in the drawing of the coupling-rods. Well, I guess that will be about all the explanation needed, so let's carry on with the good work.

Guide Bars

The guide bars are made from eight lengths of rectangular mild or silver-steel, as desired, $\frac{1}{8}$ in. × $\frac{3}{16}$ in. section for the $3\frac{1}{2}$-in. gauge engine, and $\frac{1}{8}$ in. × $\frac{1}{4}$ in. for the 5-in. size. By the good rights, the bars on the smaller engine should have only been 3/32 in. in depth, but this would have been cutting it a wee bit too fine. See drawing for lengths, and size and location of rivet holes. Note—bolts may be used instead of rivets if desired; in that case, don't countersink the holes. However, I much prefer rivets to bolts for this particular job, as the latter are liable to work loose, the nuts drop off, and the bottom bars fall out on the sleepers. Eh? Oh yes, I know very well, that the ends of the bolts could be burred over, or locknuts could be fitted; but weeny locknuts aren't always as virtuous as Mrs. Caesar was reputed to be, and you better mention riveting over the bolt ends to Inspector Meticulous—and then get ready to run! Anyway, if I were building the engine, I'd just pop a little blob of Sifbronze on each joint, and forget all about them, as they would then "stay put" till doomsday.

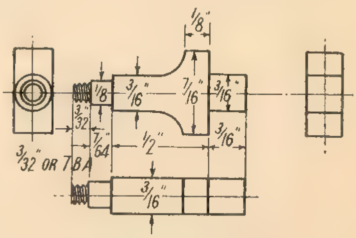
The supports at the cylinder end are made from mild-steel bar, $\frac{7}{16}$ in. × $\frac{3}{16}$ in. in $3\frac{1}{2}$-in. gauge, and $\frac{1}{2}$ in. × $\frac{1}{4}$ in. in the larger size. Chuck truly in the four-jaw and turn the circular part first, using a round-nose tool, so as to leave a radius as shown; the length for the smaller engine should be $\frac{5}{8}$ in. bare, with a diameter of $\frac{3}{16}$ in. and for the larger engine $\frac{7}{8}$ in. length and $\frac{1}{4}$ in. diameter; see drawing. Then turn the spigots to fit the holes in the stuffing-box flange of the cylinder $\frac{1}{8}$ in. and $\frac{3}{16}$ in. respectively, and finally reduce and screw the ends for the nuts, as shown. It is necessary to reduce the diameter of the threaded part as shown, as bigger nuts wouldn't fit in the space between the flange and the cylinder cover; even with the sizes given, flats will have to be filed on the sides of the stuffing-boxes when erecting. The smaller support is parted off at $\frac{11}{16}$ in. from the shoulder of the spigot, and the larger one at $1\frac{1}{16}$ in. from ditto. Four supports are needed, two for each cylinder as shown in the plan of assembly.

Milling Operations

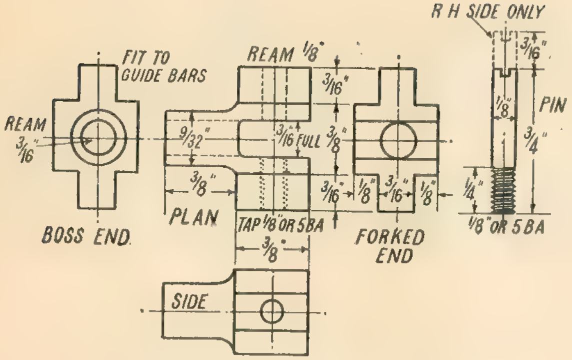
If a regular milling machine is available, all four pieces can be clamped together, end-up, in a machine-vice on the miller table, and the steps milled out with a side-and-end cutter on the arbor, taking the whole depth out at one cut. There is no need to alter the height of the table; just shift it along the required distance for the thickness of the tongue, and take out the other step, leaving the tongue between, right thickness and with exactly parallel faces. If a milling-machine is *non est*, use the lathe, doing the job in the same way as described for axleboxes, with the support either clamped under the slide-rest tool-holder, or in a small machine-vice bolted to a vertical-slide. The steps could also be machined out on a shaper or planer, if the builder has one; as a last resort, they could be rough-sawn out, and carefully trued up with a file.

The four supports for the motion-plate ends, are just a piece of cake, those for the $3\frac{1}{2}$-in. gauge engine being made from $\frac{3}{16}$ in. square mild-steel, and for the larger, from $\frac{1}{4}$ in. square material. Chuck truly in the four-jaw, face the end, turn and screw the threaded part, turn the spigot to fit the hole in the motion-plate, and part off to length as shown.

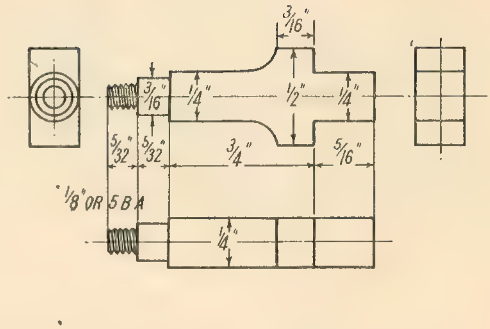
To assemble, put a guide-bar at top and bottom of the step on the cylinder-end fitting; put the motion-plate end fitting between the bars at the other end, with a toolmakers' cramp over them, to hold them tightly in place. Adjust the bars at the cylinder end to jam up tightly against the shoulders of the support, holding them in place with another cramp placed just clear of the rivet holes. Then, using the holes in the bar as guide, drill right through the tongue



Front guide-bar support—$3\frac{1}{2}$-in. gauge engine



Crosshead for 3½-in. gauge engine



Front guide-bar support—5-in. gauge engine

between them, and rivet up with bits of mild-steel rod, hammered down into the countersinks, and filed off flush. Repeat drilling and riveting operation at the other end. The whole issue should then be a rigid unit. The same process applies if bolts are used instead of rivets, but the nuts must be very tight. Weeny spring washers (as sold by Reeves) could be used with advantage; I used plenty on my L.B. & S.C.R. *Grosvenor*. If there should be any slackness after assembly, I should recommend brazing the bars to the supports, but be careful how they are cleaned up afterwards; it would be a pity to spoil their pristine beauty, not to mention getting them " oot o' plumb ! "

Crossheads

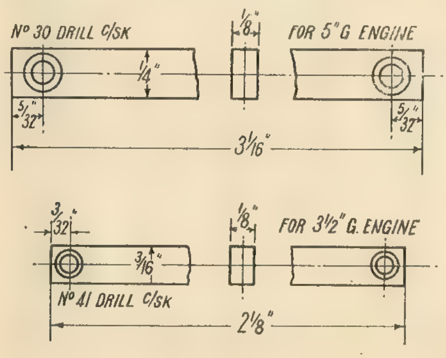
When I made the crossheads for the outside cylinders of *Jeanie Deans*, which are exactly similar, I used a piece of rectangular phosphor-bronze rod long enough for both, and of correct section. This was held in a machine-vice on the milling-machine table, edge up, and the corners milled away to form the shoes or slippers (sounds like a cobbler's job, doesn't it ?) without altering the height of the table. The piece was then turned over, and the other side given a dose of the same medicine. It was then chucked truly in the four-jaw, the boss turned on one end, and drilled for the piston-rod; then it was turned end-for-end, and the operation repeated. A parting-tool then promptly divided it; the two parts were then drilled for crosshead pins, and a side-and-face cutter of right width, cut out each jaw at one fell swoop. Lucky owners of milling-machines can follow suit with the crossheads illustrated, working to the dimensions specified.

Milling the Tongues

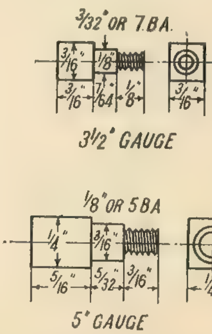
If the lathe is the only available machine-tool, mill the tongues forming the slippers exactly as described for axleboxes, clamping the metal under the slide-rest tool-holder, and operating on it with an end-mill in the three-jaw. Bronze or gunmetal bar of ½ in. × ⅜ in. section will be required for the 3½-in. gauge engine, and of 1 in. × ½ in. section for the 5-in. job. It is quite possible that our advertisers will supply cast bar with the corners rebated, or maybe even cast crossheads of correct shape. After machining the slippers, saw the piece in half, chuck each truly in the four-jaw, and turn and drill the boss, using a round-nose tool for the turning; then reverse in chuck, and face off the end for the fork. The latter is cut by clamping the piece under the slide-rest toolholder, and feeding it up to a cutter either mounted on a spindle, or on a stub mandrel held in the chuck, same as described for slotting valve-gear forks on *Tich* and other engines described in these notes. To hold the crossheads for this purpose, drill a hole 9/32 in. or ⅜ in. according to size of crosshead, in the end of a piece of square rod which will fit the tool-holder, and fit a set-screw. Put the boss of the crosshead in the hole, tighten the set-screw, clamp the square rod under the tool-holder, and you're all set. Tip—drill the cross hole for the pin, with a tapping-size drill, *before* slotting out the fork; after slotting, open out the clearing side with the given size of reamer, and tap the other side to take the screwed part of the pin. This is just a piece of round, silver-steel, screwed at one end and slotted at the other, as shown, to take a screwdriver. As the crosshead pump will be driven from the right-hand pin, one pin will be longer than the other.

Connecting-rods

The easiest way of making the main part of the connecting-rod, is to turn it between centres, using a piece of rectangular mild-steel bar about 2 in. longer than required, to allow for a driving carrier.



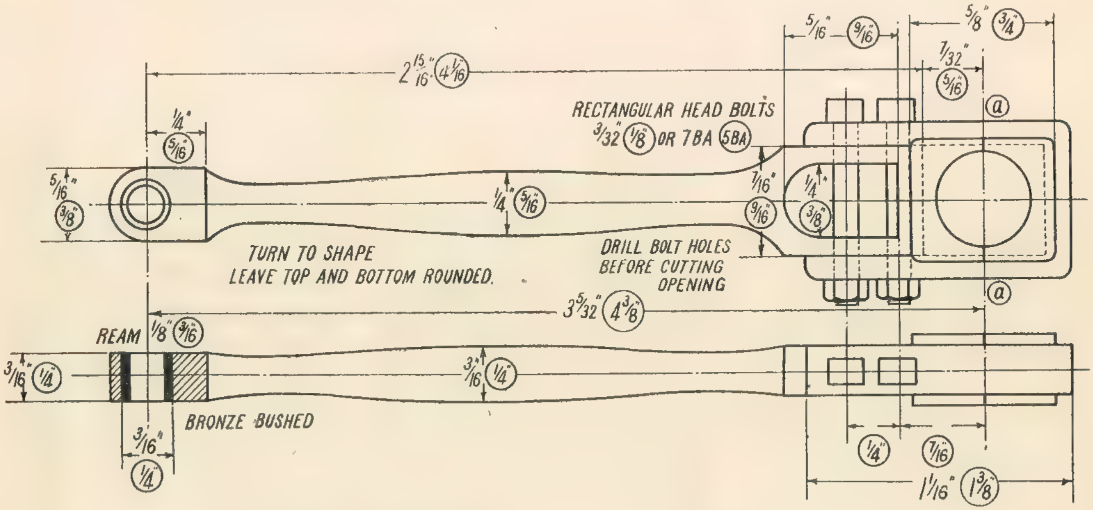
Guide bars



Guide-bar supports at motion-plate end

Section of bar for $3\frac{1}{2}$-in. gauge engine is $\frac{7}{16}$ in. × $\frac{3}{16}$ in. and for the 5-in. gauge job, $\frac{9}{16}$ in. × $\frac{1}{4}$ in. If the exact sizes are not available, use the nearest wider, as it is easy enough to reduce the width of the big-end, to dimensions as shown. Square off both ends with a file—no need to be too elaborate about this !—carefully mark off the centres, and centre-pop them. Open them with a small centre-drill (I use size E) *after* pressing it in. Don't do anything more to the big-end yet. If you admire Inspector Meticulous so much that you just *have* to make the little-end to his liking, make it just like the end of the coupling-rod, instead of just a plain rounded end as shown.

The easiest way to make the strap, is to bend it up from a piece of strip steel, of requisite width and thickness. The full-size ones were



Details of connecting-rod

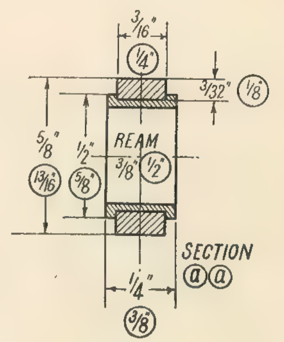
and mount the bar between centres with a carrier on one end. Turn to size and outline given, with a round-nose tool. The middle part of the rod won't clean up to a perfectly-circular section, but that doesn't matter a bean, as the appearance is correct, and the rod is of adequate strength. Run the parting-tool in at each end, as far as possible without knocking the rod out of centres; then remove from lathe, and cut off the superfluous bits with a hacksaw, smoothing off the pips at the big end with a file, and rounding off the little end as shown.

If a piece of bar wider than the finished width of big-end has been used, first reduce this to specifiec width, and then carefully mark off the centre of the little-end bush. Note that this should be, on the $3\frac{1}{2}$-in. gauge engine, $2\frac{15}{16}$ in. from the end, and on the 5-in. gauge engine, $4\frac{1}{16}$ in. from the end, to maintain correct distance between centres of bearings. Drill out the little-end, and fit a bronze bush as shown, a simple job requiring no detailed instructions. Ream the bush

made like that, by the brother of the village blacksmith, who, unofficial history tells us, forsook the spreading chestnut tree for the locomotive shops. Some of these old craftsmen did wonderful work, mostly by hand, as machine-tools were few and far between, and woefully inadequate, in those days. Good quality mild-steel should bend easily, without cracking at the corners; I had no trouble in making a perfect strap for *Jeanie Dean's* inside big-end, at the first shot. I didn't have the Diacro bending-brake then, so just used a piece of bar of right width, as a former, and bent the strap around it. Builders of this engine can do the same; use a piece of steel long enough to allow for easy bending, then cut it to correct length afterwards. The $3\frac{1}{2}$-in. gauge engine needs 3/32in. × $\frac{3}{16}$ in. strip, and the 5-in. gauge, $\frac{1}{8}$ in. × $\frac{1}{4}$ in. If the corner cracks when you make the first bend, cut it off, heat the strip to red, and make the other bends with the metal hot. It will discolour, naturally, but can very easily be cleaned up afterwards.

Big-end Brasses

My favourite way of making split big-end brasses, is to use two pieces of metal, each half the width of the finished bearing; solder them edge to edge, then machine up, and melt apart after. In the present instance, you would need for each bearing of the $3\frac{1}{2}$-in. gauge engine, two pieces of good-quality bronze or gunmetal, $\frac{5}{16}$ in. × $\frac{1}{4}$ in. section, and a full $\frac{1}{2}$ in. long. The larger



engine would need two pieces $\frac{3}{8}$ in. square, and full $\frac{5}{8}$ in. long. Clean one narrow side of each, and solder together, to form a rectangle, $\frac{5}{8}$ in. × $\frac{1}{2}$ in. full for the smaller engine, and $\frac{3}{4}$ in. × $\frac{5}{8}$ in. full, for the larger one. First trim the "full" lengths to dead size; then, by the same process described for axleboxes, mill a groove all the way around. The depth of this should be such, that the measurement across the narrower diameter is exactly the same as the width of the big-end

of the connecting-rod; see the dotted lines in the drawing. The two ends should be milled to the same depth, and the sharp corners slightly rounded off with a file; the corners of the flanges may also be rounded off, for appearance sake.

Now, in the centre of the block, and right on the joint, make a centre-pop. Hold the block in the bench vice whilst doing this, for if you split the two halves apart, you've had it. Chuck in four-jaw with the pop-mark running truly; check it by bringing up the tailstock centre. Open out the pop-mark with a centre-drill, then drill a $\frac{3}{16}$-in. pilot hole, opening up with a larger drill to a shade under finished size, finishing with a reamer as shown in the drawing. Take off the sharp edges of the hole with a scraper, whilst the piece is still in the chuck; then remove, mark the halves so that they can be replaced correctly, and melt them apart, wiping off all superfluous solder. Mark off the position of the bolt holes on the strap; place brasses against the end of the connecting-rod, and put the strap over. Clamp it tightly in place endwise, then drill clean through the thickness of strap and end of connecting-rod, using No. 41 or No. 30 drill, as the case may be. These holes *must* go through truly, an easy job if you have a bench or pillar drilling machine, with a machine-vice; if not, use the lathe, with a drilling-pad on the tailstock barrel, and drill from both sides of the strap, so that the holes meet in the middle. File off any burring. The bolts can be made from 3/32 in. or $\frac{1}{8}$ in. round silver-steel, screwed at both ends and nutted; if desired, the top nuts can be filed to represent the cotter ends of the full-sized engine, as shown, but personally, I wouldn't trouble ! No oil cups are fitted to the big-ends, as they wouldn't clear the bottom of the boiler barrel.

To give the connecting-rod its final old-fashioned touch, take off the strap and brasses, and drill a hole through the big-end, $\frac{1}{4}$ in. or $\frac{3}{8}$ in. according to size of engine, and file the hole to the arch-shape shown. This hole will cut half-way through the bolt-hole nearest the brasses.

If the spigot at the cylinder end of the guide-bar assembly is pushed right through the hole in the flange on the cylinder cover, the nut won't go on, so hold the nut in place when pushing the spigot through, entering the screw into the nut as it is inserted. Then, if the nut is turned by the aid of a small spanner, it will pull the spigot right home. Note, it will be necessary to file flats on the side of the stuffing-box between cylinder cover and flange, to allow the nuts to turn, which explains why we couldn't leave the spigots full size and screw them. The holes couldn't be tapped, instead of using nuts, as the guide bar assembly couldn't be turned with the crosshead in place. After fitting one bar, put the crosshead between, and fit the other bar; don't forget that the tapped side of the crosshead goes nearest the centre-line of the engine. Push the crosshead a little way on to the piston-rod, then repeat operations on the other cylinder. Then put the cylinder-block in place between the inside frames, with the spigots on the outer ends of the guide-bars going through the holes in the motion-plate. These need not be nutted yet, as the cylinders will have to come down again, for the erection of other parts. Just put three or four screws through the frame, into the cylinder block, to hold the lot temporarily in place.

Take out the big-end bolts, and remove strap and brasses; put the little-end through the slot in the motion-plate, and insert into the crosshead fork. Put the crosshead pin in from outside; then put the brasses over the crankpin, and line up the connecting-rod with them, butting the brasses against the end of it. Put on the strap, and insert bolts, nutting up underneath. Spring washers could with advantage be used here, as there is plenty of "kick" at this point when the old girl really sets her back into the job. Put the crank on front dead centre, which movement will push the piston-rod right home, the piston hitting the cylinder cover, and the crosshead boss sliding over the piston-rod as far as possible. Now, make a mark on the piston-rod, 1/32 in. from the crosshead boss on the 3½-in. gauge engine, and $\frac{1}{16}$ in. on the 5-in. engine. Take off the front cylinder covers, and gently tap at the pistons until the mark is level with the crosshead boss; this will give the correct clearance between pistons and covers at each end of the stroke. Replace covers, and drill holes right through crosshead boss and piston-rod, using No. 43 or 32 drill, according to size of engine. Squeeze in little pieces of 3/32-in. or $\frac{1}{8}$-in. silver-steel rod, to act as cotters. If desired, the holes can be drilled two or three sizes smaller, reamed with a taper broach, and standard taper pins fitted, same as used in motor work. If the wheels are now turned by hand, the connecting-rods and crossheads should work nicely without tight places anywhere in the movement. If O.K. you can pass the job as ready for fitting the crosshead pump and the valve gear.

S.O.S.—Please note an error in dimensioning the 5-in. gauge motion-plate. Distance from centre-line of engine to centre of connecting-rod slot, should be 1¼ in., not 1⅜ in. Sincere apologies !

THE PLANT CENTENARIAN

The special train which will make two runs, each time behind the two G.N.R. Atlantic locomotives No. 990, *Henry Oakley*, and No. 251, in September, is to be known as "The Plant Centenarian." On Sunday, September 20th, the train will depart from King's Cross at 10.40 a.m., arriving at Doncaster at 2.4 p.m. The following week, Sunday, September 27th, the train will depart from Leeds Central at 8.45 a.m. and from Doncaster at 11.15 a.m. arriving at Kings Cross at about 2.35 p.m.

On each date the return trip will be made by the celebrated Gresley Class A4 Pacific *Silver Link* and so timed as to provide opportunities for some high-speed running. On both occasions, approximately 1 hour 45 min. will be spent at Doncaster, for a visit to the works where the Stirling 8-ft. single-wheeler No. 1 will be on view.

The cost of tickets from London on September 20th will be 55s., and the same from Doncaster on September 27th. The price from Leeds on September 27th will be 58s. 6d. In each case, this amount covers the return rail fare, reserved seat, guide fee for Works' tour at Doncaster, and two meals. Provided both trains are full, it is proposed also to send everyone a souvenir brochure after the trips are over.

Applications for tickets should be made as under :—

For *September 20th* :

To Mr. H. T. S. Bailey, 80, Bessborough Place, London, S.W.1.

For *September 27th* :

To Mr. A. F. Pegler, White Lodge, Rampton, Retford, Notts.

Enquiries should be made by letter, enclosing a stamped addressed envelope.

The Model Engineering Centre, Wade Lane, Leeds; Carters, Bridge Street, Bradford; and Attenborough Model Railways, 82 Arkwright, Street, Nottingham can also supply tickets for September 27th.

MAKING A SMALL MACHINE VICE

By "Duplex"

MAKING a small, accurate machine vice, besides furnishing the workshop with an essential piece of equipment, will serve as a useful exercise for the beginner in filing, machining, and fitting.

Moreover, the work can, where necessary, be carried out solely with the aid of hand tools and a drilling machine, although a lathe will be helpful for some parts of the construction.

With jaws $2\frac{3}{8}$ in. in width and opening to $1\frac{3}{8}$ in., the vice will hold work of reasonable size, and the design of the moving jaw ensures that the work will not rise or tilt when the clamping pressure is applied.

The Baseplate A

The length of $\frac{3}{8}$-in. mild-steel strip used for the baseplate should be filed square and with its upper and lower surfaces flat and parallel, but some will find it easier to do this by machining the material on the lathe faceplate.

For this purpose, four of the holes shown in the drawing should be first drilled and tapped $\frac{1}{4}$-in. B.S.F. so that the work can be secured to the faceplate with screws inserted from behind. When forming tapped holes which have later to be opened out to the clearing size, it is important to counter-drill the mouths of the holes to the full size for a depth equal to one and a-half or two screw threads; this provides a guide for the drill point and prevents the threads pushing the drill off-centre. Furthermore, all tapped holes used in the construction should be dealt with in this way, in order to avoid setting up burrs that would interfere with the proper seating of the parts.

The four-jaw chuck can, of course, be used to hold the material when taking surfacing cuts, but it is sometimes difficult to keep the work from rising away from the jaw faces as the clamping pressure is applied; this would lead to the two work faces being machined out of parallel. However, small parts can often be kept properly seated during setting up by applying pressure with the tailstock. The work, when centrally mounted, will revolve at its periphery on a radius of about $2\frac{3}{4}$ in., corresponding to a circumference of approximately 8 in., or 2/3 ft. Where a high-speed steel tool is used, a surface speed of 100 ft. a minute is permissible, and the lathe can, therefore, be set to run not faster than $\frac{100}{1} \times \frac{3}{2}$ r.p.m., or 150 r.p.m.

After one surface has been machined, the work is turned over and the machining repeated. Finally, the baseplate should be checked on the surface-plate and any errors corrected by hand-scraping.

The remaining screw holes can now be drilled, but the recesses for the heads of the Allen screws should not be machined until later, as the full depth of the hole is needed to serve as a drilling guide.

The Fixed Jaw B

This part can quite well be filed true and square, and, if necessary, finished by hand-scraping; but, where this is not acceptable, the work can be mounted in the four-jaw chuck and machined on all faces. A shaping machine of good quality is, however, ideal for this kind of work and can be relied on to finish parts of this sort with great accuracy. When attaching the fixed jaw to the baseplate, the parts should be set square with one another and then securely held in position with toolmaker's clamps. The holes in the baseplate will then serve to guide the clearing-size drill which is used to spot the centre in the lower part to a depth of $\frac{1}{16}$ in. or so. Next, the tapping-size drill is entered to the required depth by referring to the depthing scale fitted to the drilling machine. If the hole is threaded

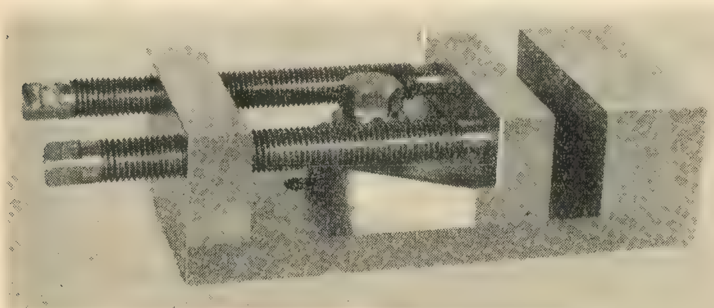
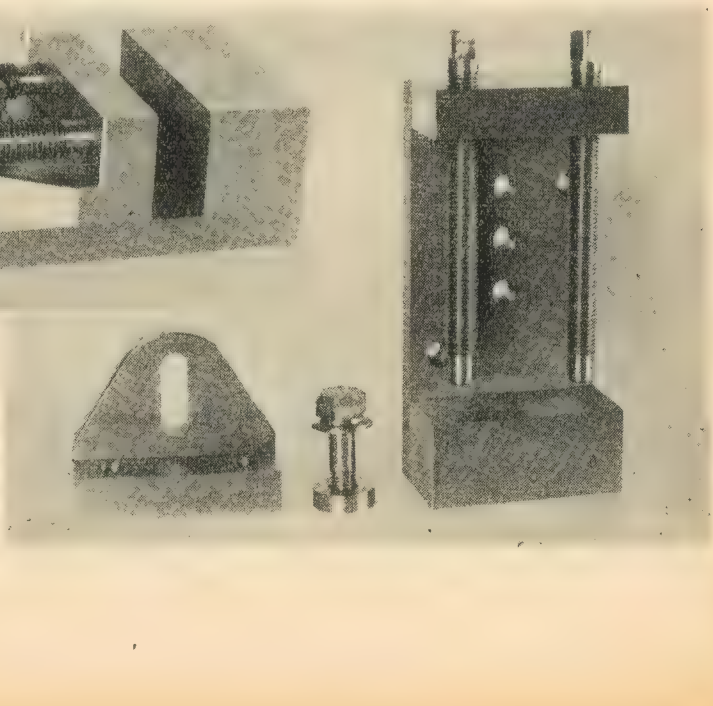


Fig. 1. Showing the finished small machine vice



(*Right*) *Fig. 2. The component parts of the small machine vice*

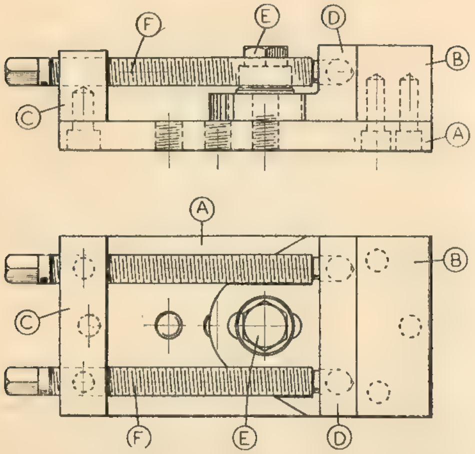


Fig. 3. A—the baseplate; B—the fixed jaw; C—the end bracket; D—the moving jaw; E—the clamp-screw; F—the jack-screws

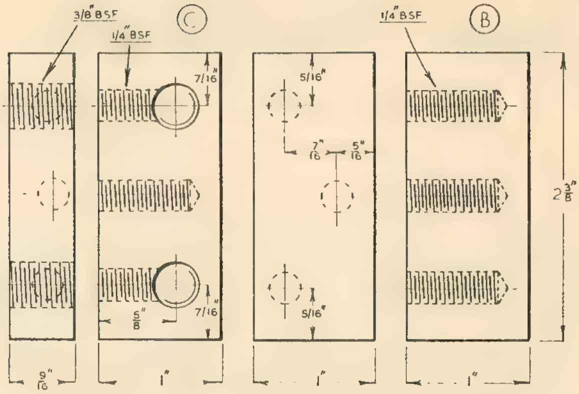


Fig. 5. The fixed jaw—B and the bracket—C

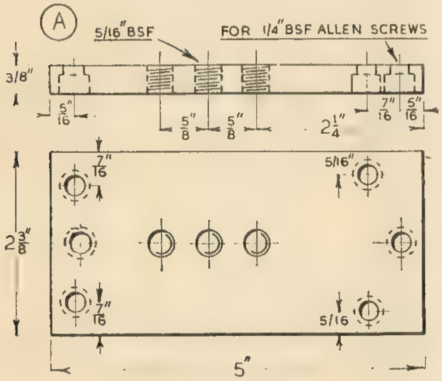


Fig. 4. The baseplate

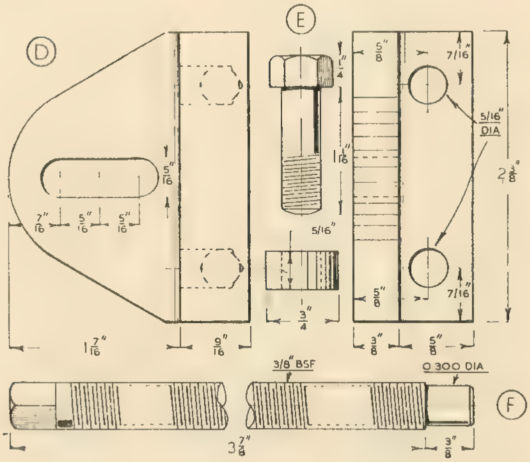


Fig. 6. The moving jaw—D; the clamp-screw and collar—E; the jack-screw—F

with the parts still in position, the tap will be correctly guided.

The recesses for the heads of the Allen screws are first drilled nearly to the full depth, and the flat abutment face is then formed with either a counterbore or an end-mill.

The Bracket C

The two jack-screws are carried in the bracket *C*. This part is machined and also secured to the baseplate in the same way as the fixed jaw, but it is important to tap the bracket accurately so that the long screws will line up correctly.

When doing the tapping with the work held in the bench vice, the alignment of the tap should be frequently checked in two planes at right-angles to one another by means of a small try-square resting on the work surface.

The Movable Jaw D

The movable jaw is cut to shape from the solid; but, first, the standing face of the jaw and its under surface are filed or machined flat and square. The surplus metal is removed with the hacksaw and the surface afterwards finished by filing. The jaw slot is formed by drilling a series of holes in line and then finishing the slot to size with round and flat files. The holes to receive the ends of the jack-screws are drilled to take a $\frac{5}{16}$ in. diameter bearing ball, and these holes must be accurately located, by careful marking-out, to correspond with those already drilled in the end bracket. In this connection, it will help to locate the centres, if the cross centre-lines scribed on the bracket are preserved as a guide for setting the dividers and jenny calipers when making the transfer. An alternative method is to place the parts on a surface plate and then to mark-out both components at the same setting of the surface gauge.

The Jack-screws F

These are made from $\frac{3}{8}$ in. diameter mild-steel rod and threaded with a die to turn smoothly in the threaded holes in the bracket. If the thread is not screwcut in the lathe, it is advisable to mount the die in a dieholder fitted with a guide collet. In the drawing, the ends of the screws are shown as reduced to 0.300 in. diameter; but, if a lathe is not avilable for the purpose, the mouths of the holes should, instead, be correspondingly enlarged. A cross-handled, socket key is used for tightening the jack-screws, and

(*Continued on page* 319)

Arc Welding

By J. W. Cooper

THERE is no doubt a large number of amateur mechanics who are interested in one way or another in the methods of welding of metals by the use of electricity ; a process known as " arc welding." Most will know that either direct or alternating currents may be used for this purpose : unfortunately, however, rather vague ideas exist as to the necessary apparatus needed for this work.

Let me say, at the outset, that all types of welding equipment lie in a field of their own, and that the apparatus used is of a special nature : ordinary generators and transformers will be found to be quite unsuitable for use for welding, because they have not been designed specially for this application, and therefore do not have the required characteristics.

The voltages necessary for welding will lie between 80 and 100 volts ; although the arc does not operate at these voltages, these values are necessary to enable the arc to be satisfactorily struck, after which the voltage has to be reduced to a value that will satisfy working conditions. From this it will be seen that some means has to be provided to accommodate this condition ; in other words, some form of regulator is called for to reduce the voltage after the arc has struck. In practice, this could not be done by hand, so this indicates that the regulation must be made more or less automatic. To cater for the required control, the apparatus, whether direct or alternating, is designed to have what is called a " drooping " characteristic ; that is to say, after the arc is struck at the higher voltage, the volts automatically drop to a value to suit the arc.

Dealing with the direct current method, this effect is obtained by reverse compounding of the generator, that is to say, the compound coil of the field system is arranged so that any current flowing in it will be in the opposite direction to that of the main field ; also and for purposes of stability, it may be necessary to arrange for separate excitation of the field. Another way in which the drooping effect is attained is to make use of armature reaction. This usually means a strong armature current and a weak field ; specially-shaped field pole pieces are usually necessary here.

Where alternating current is used, the same characteristic must rule. Here the transformer is designed to cater for this ; the effect is obtained by arranging for a certain amount of magnetic leakage in the transformer, and this means that it has to be built with two separate coils side by side, on two limbs. The magnetic coupling is now looser than with the usual type, having the coils wound one over the other ; it may also be necessary to distribute the coils in addition. Apart from the drooping effect of the transformer, it is usually necessary to provide for further regulation by the provision of a choke coil in the arc circuit itself. The class of choke coil used is of the open core type, just a simple coil having a movable core that may be adjusted in the required position in the coil. Where a coil of this type is used, it is necessary to arrange for some form of clamping device, so that the core may be held fast in position against the magnetic pull that exists when the coil is in use. In some systems this coil is arranged to have a number of tappings at suitable intervals, to agree with different current values. Sometimes some of the choking effect is provided by the transformer itself, as well as the choke while in action.

Welding currents will vary over a wide range, and in accordance with the work being done. In the smaller applications, currents up to 100 amps may be sufficient ; in other directions, however, values up to 300 amps and over may be called for where welding rods reach large diameters. So far as the thickness of metals is concerned, 20-gauge would be about the smallest size upon which satisfactory work could be done.

No form of welding in the true sense can be carried out at voltages as low as 6 or 12 ; in the ordinary way about 40 volts is necessary for an arc to be struck. There are, of course, outfits available operating from car batteries and low-voltage transformers ; but this is not welding. These outfits, however, can serve a very useful purpose by providing a source of intense local heat, and would lend to a wide range of soldering operations, brazing and silver-soldering, where an iron or blowlamp would be impracticable. With this class of apparatus, the best results will be obtained by the use of carbon rods as electrodes ; their sizes may vary between $\frac{1}{8}$ in. and $\frac{1}{4}$ in. diameter, and currents up to 200 amps may be necessary.

The only instance in which a low voltage is used in welding is in the resistance method of welding ; here the voltage lies between 1 and 3 only ; currents may have values up to 6,000 amps and over. Where resistance welding is used for joining metals, the heat is provided by the contact resistance of the metal itself. When the two contact points are brought together under suitable pressure, the current flowing is sufficient to actually melt the metal ; at this instant, further pressure is

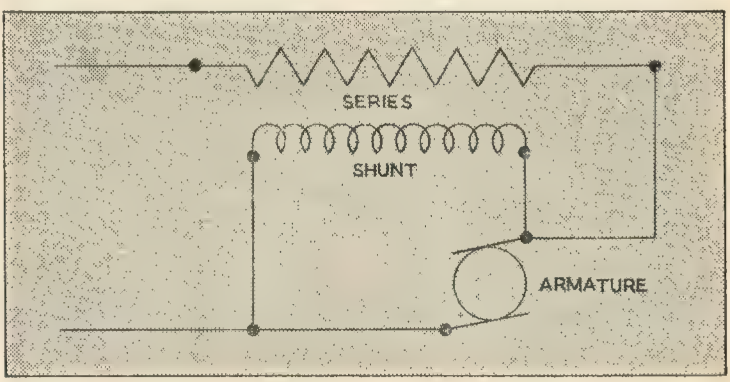


Fig. 1. Normal compound field connections

applied and the current cut off. The applications of resistance welding finds a field in joining wires or rods (butt welding), spot welding, in which a very localised heat is used to make the joint, seam welding, and numerous other kinds of special work can be done by this method.

The electrodes used in arc welding are also of a special nature ; ordinary steel or other metal rods cannot be used. They vary in accordance with the particular metal, and need to be coated with some form of fluxing medium ; in several instances this fluxing is carried out in different ways to suit the weld conditions. Any maker of welding equipment would supply the correct electrode if full details of the work contemplated are given.

The tables given below show the current values and electrode sizes for steel plate from $\frac{1}{16}$ in. to 1 in. ; this table does not cover all types of electrodes, but represents the most suitable range for steel plate, and for butt welds.

Where any form of arc welding is contemplated, the local supply authority should be consulted, because the use of welding equipment can cause a considerable disturbance of the supply, and can be a nuisance to other consumers connected to the same supply cable. It is usually necessary to provide for power factor correction, so far as the welding plant is concerned ; this is done by connecting a suitable condenser across the transformer primary. As the ratings of welding transformers are widely different from the ordinary transformer working in air, it is usual to arrange for these transformers to be oil-cooled ; in some manufactures the whole outfit is oil-immersed, that is, the transformer, the condenser and the choke coil are all in the same tank. It should be stressed that where the local supply is used, the ruling regulations should be observed, and in addition the rules apertaining to the installation of welding equipment.

Thickness of Metal	Electrode	Current in amps.
$\frac{1}{8}$ in.	12	80
$\frac{3}{16}$ in.	10	115-150
$\frac{1}{4}$ in.	10-8	115-150
$\frac{3}{8}$ in.	10-8	115-150
$\frac{1}{2}$ in.	10-8	115-150
$\frac{5}{8}$ in.	10-6	115-200
$\frac{3}{4}$ in.	10-6	115-200
$\frac{7}{8}$ in.	10-6	115-200
1 in.	10-6	115-200

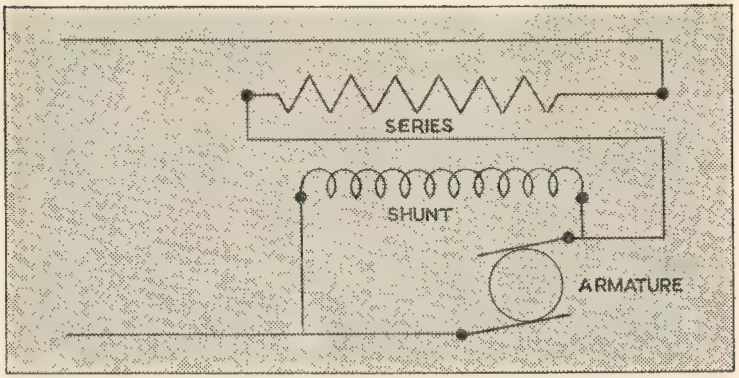


Fig. 2. Compound field coil connections with series coil reversed

Figs. 1 and 2 show compound connections and the reversal of the series coil to obtain reverse compounding. Where the ordinary compound generator is concerned, the reversal of the series coil will not necessarily provide the amount of volt drop required, because the existing turns may be too many or too few. The shunt magnetising force will vary with different designers' ideas, as will the series magnetic effect. Any attempt at reverse compounding on an ordinary generator must, therefore, be experimental, either by taking off or adding series turns until the required conditions are reached. With a plain shunt generator, series turns may be added if there is sufficient space for this ; these turns cannot be calculated, as no data of the field will be known, here again it is a case of trial and error. Where series turns are dealt with, the wire used must be capable of carrying the whole output current in amps and when checking for the reverse compound value, the test must, of course, be carried out on full load.

MAKING A SMALL MACHINE VICE

(*Continued from page* 317)

their ends are, therefore, carefully filed to fit a commercial key, such as that made for turning the cocks of hot water radiators or removing carburettor jets. However, a description of making square socket keys was given recently in an article published in this journal.

The squared end of the screw can easily be formed by using a filing rest in the lathe, but there is no great difficulty in doing this in the bench vice with the aid of a micrometer and small try-square.

The Jaw Clamp-screw and Collar E

Although a hexagon-headed clamp-screw is shown in the drawing, the vice will, perhaps, be operated more conveniently, and the need for a second spanner avoided, if this screw is also made with a square head to fit the socket spanner.

Using the Vice.

The three positions of the clamp-screw allow the movable jaw to be closed or fully opened. When gripping work, the clamp-screw is, first, lightly tightened and the jack-screws are then evenly adjusted to hold the work securely; finally, the clamp-screw is fully tightened to ensure that the work beds down on the floor of the vice. Tapered work is gripped in the same way by tightening the jack-screws to press the movable jaw evenly against the work-piece.

It will be noticed that hardened, inset jaw-plates have not been fitted, but both the work and the jaw faces will be protected from damage if, instead, either sheet-copper clams or strips of card are used.

Where the vice has to be secured to the drilling machine table or to the lathe faceplate or saddle, the baseplate is drilled to take Allen screws, as can be seen in Fig. 2, so that a sole-plate can be attached for bolting down on the machine.

Horizontal Surface Grinding and Milling Machine

By R. Hamilton

THE trays were fashioned from suitable channel iron, webs cut down, and faced in lathe. The radius on one of the webs was removed by end milling. Side pieces to trays were screwed in place by B.A. countersunk screws.

Clasp nut and guide assembly were screwed into position (see General Arrangement B), then the holes through table under slide and nut drilled in one operation, the hole in the slide end being amply opened up to clear the feedscrew. Another hole, in axial alignment, is drilled in the opposite end of the slide. This is to permit the free passage of the long feedscrew, which travels with the table and to act as a housing for the after end of the brass tube which retains the feedscrew in its normal axis when the clasp nut is open for grinding operations. The clasp nut is actuated exactly as on the M.L.7, except that the guide is square sided and not veed. Slitting of the nut was left till the cam assembly had been fitted, which simplified the lining up of nut studs and cam slots. Studs are of silver-steel.

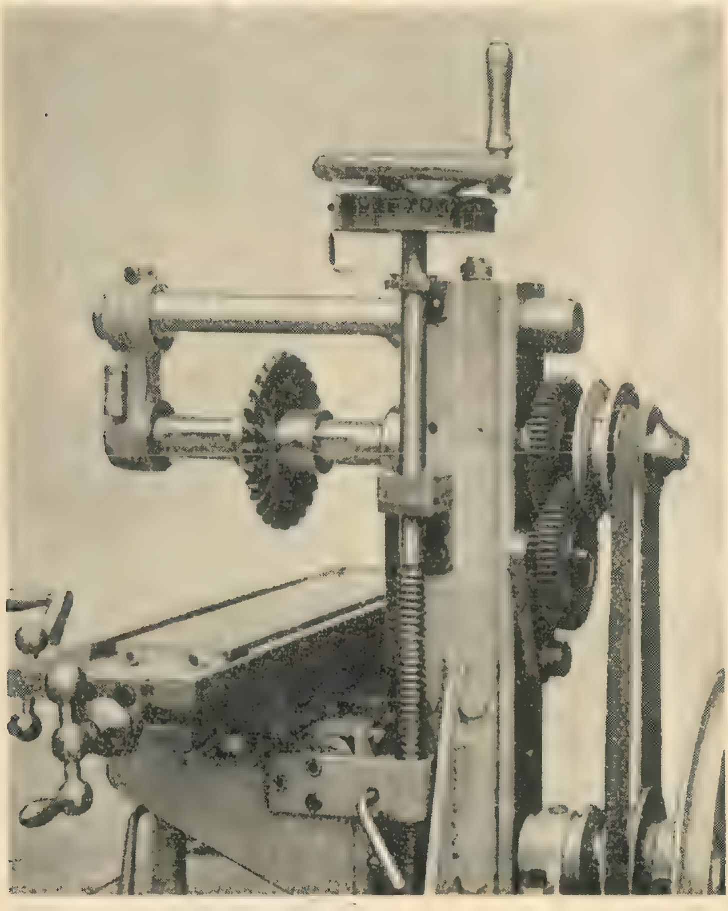
Concluded from page 268, *August* 27, 1953.

The rack pinion and housing parts need no comment (see General Arrangement "A"). The housing is bushed and oilwayed. The handle not shown, pulls off when not in use, by slackening a $\frac{3}{16}$ in. Allen screw.

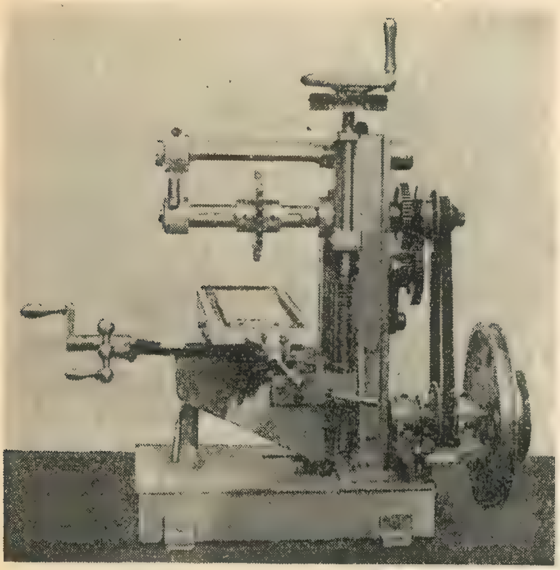
Locking levers are fitted to vertical- and cross-slides; a long cap screw serves this purpose on table-slide. A ram-like support (see photographs) counters any tendency of the knee to dip under load. A hole requires to be drilled in the platform to allow the plunger to pass through. A flat on the plunger takes any bruising by locking the lever point.

When throwing the table during grinding, the clasp nut being open, the feedscrew would wobble and foul unless retained in its normal path in some way. I got over this difficulty as follows: A brass tube, mentioned above, with an I.D. just sufficient to accommodate the $\frac{3}{8}$-in. feedscrew, has one end housed in the hole at the after end of the slide. The other end, very slightly bell-mouthed, is soldered to a brass cradle which is screwed to nut guide and just clears the rear face of the nut (see General Arrangement B, in which the tube is shown in heavy black). The idea works very well and does no damage to the screw.

The rack was cut on the lathe as follows: Two $1\frac{1}{4}$ in. (or thereabout) broad plates, $\frac{5}{16}$ in. thick, each fractionally over half rack length, were bolted together to an angle-plate, being packed off the angle-face by about 1 in. Angle-plate was set on table, parallel with and behind lathe axis. A $1\frac{1}{2}$ in. diameter cutter was made, with a tooth formation to fit lathe rack and mounted on a mandrel between centres. The plates were packed up so that tooth depth was cut at one pass. An indexing device was made, consisting of a small block to which was screwed a short stiff rod, the end of which was filed to tooth shape. The device was placed on thread dial indicator

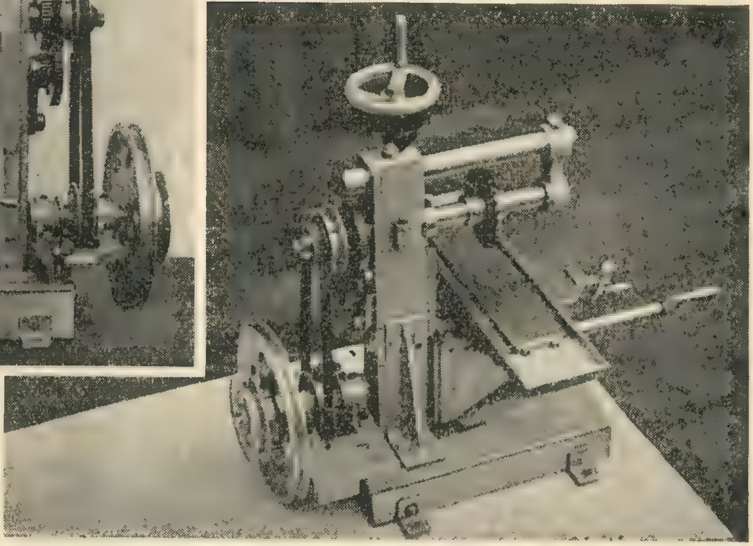


The machine set up for horizontal milling.



(*Left*). *Side view of complete machine.*

(*Below*). *A view from a high level at the rear.*



stud. When pivoted forward, the shaped point engaged a rack tooth. Saddle was locked and a cut made. And so on. Two strips were cut off plates and cleaned up. After screwing rack into place, the four holes to take table gib strip adjustment screws were drilled through rack and fixed strip in one operation. The rack is anchored to left-hand tray by a small bracket.

Spindle, Overarm and Bracket, Arbors and Elevating Screw

Drawings of spindle, overarm and arbors explain themselves. All were ground finished on lathe. As can be seen, a close fitting dirt excluding cover is fitted at spindle front and another can be pushed on to bracket to protect the ball thrust and race, most important requirements when grinding. Spindle bush is of gunmetal. It is cross-slotted down to centre-line a third way in from each end with lengthwise slots on top breaking in. A somewhat queer design, readers will comment, but it gives no trouble. Adjustment is by set screws through column side. It is also oilwayed. Overarm bracket was machined on lathe (a faceplate job) as far as possible and finished by filing. A ball thrust and race combined is inserted in bracket and a gunmetal bush also fitted to act as a steady. Lubrication cups are fitted, as shown on photographs. Milling arbor is keywayed and cutter retaining collars ground on faces at right-angle to bore. This simple method of locating cutters has proved effective. Grinding wheel, with its two large collars, is locked against the shoulder of its arbor by a screwed sleeve and nut, Allen-keyed to a filed flat on arbor. Sleeve is a gas pipe union cut down. Elevating screw is in two parts, locked together by a push-out silver steel pin. Oilways are cut in collar and an oil hole drilled in collar block. Collar block bracket and top supporting bracket are made from angle-iron and on former, both faces are carefully finished so that collar bears down perfectly. Cross traverse and elevating feed-screw nuts are replaceable.

Having no dividing head (yet), I hand-calibrated the elevating screw index thus: A black coloured aluminium strip ($10\frac{5}{16}$ in.) long, was pinned to a flat board and a 12-in. rule likewise pinned against its lower edge. Using a small square I scribed each $\frac{1}{16}$ in., grouping every five and ignoring the odd one. The strip was pinned to a disc turned to suitable size. As an improvisation it will serve till I have a dividing head. The pointer is held in place by the hexagonal-headed screw which locks the overarm.

Pulley Arrangement, Backgear, Countershaft and Sundry Items

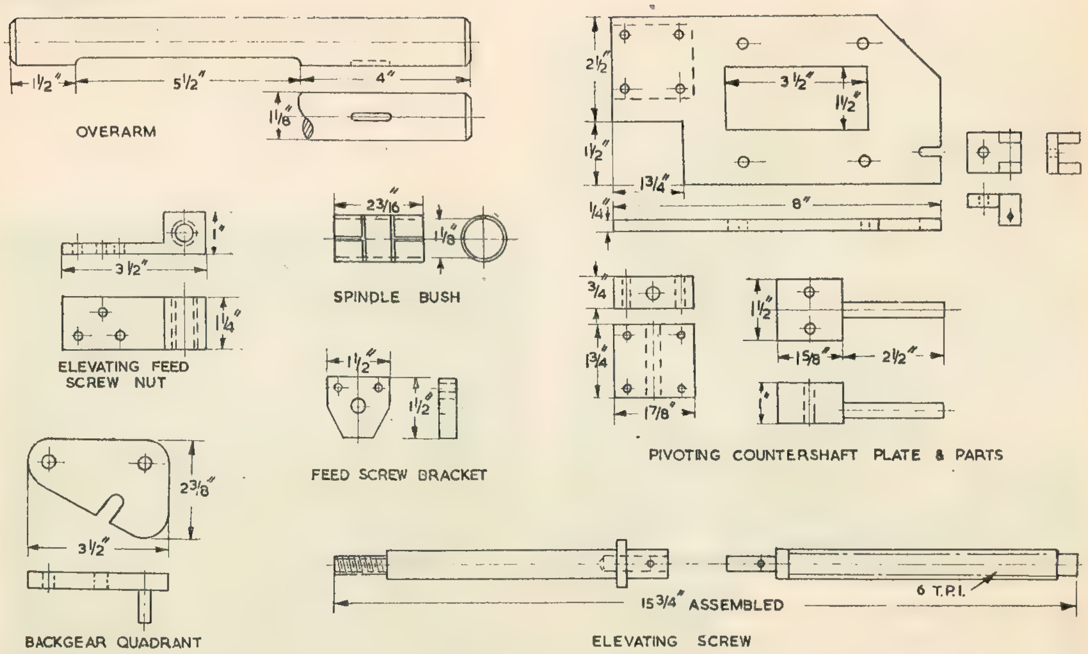
General arrangement drawings C, D and E more or less remove the need for any comments in respect of the pulley drive, countershaft and backgear layouts. Bull wheel (60-teeth) is pinned to a steel boss and Allen-keyed to spindle. For direct drive, pulley cluster is locked to spindle by an Allen key, the point of which enters a small groove to prevent bruising. Backgear wheels, separated by a thin washer, slide on to a shouldered bush and are key-coupled. A projecting pin on quadrant, striking column edge, prevents over-meshing. The primary drive pulleys are mounted on the overhung shaft. The backgear and rack pinions can be removed in a few seconds, when required for use on lathe.

The 8-in. pulley is used for milling, and when grinding, a separate belt is placed on the 4 in. one. A $\frac{1}{4}$-h.p. motor (1,440) r.p.m., has a $1\frac{3}{4}$-in. milling and a 4-in. grinding pulley.

Milling speeds: 52, 118, 210 and 472. Backgear 4 to 1.

Grinding speed: 2,160—secondary drive 3 in. to 2 in.

Vibration has not troubled me, nor has overheating appeared at grinding speed. Before grinding, however, I run machine at 210 r.p.m. for a time to warm it up. I think a 1/3-h.p. motor would be more suitable and maybe I shall fit one some day. Milling cuts can be taken quite heavily, depending, of



course, on type of cutter and speed used.

In the course of making such a machine as this, any constructor, who is limited in the equipment at his disposal, as I was, will find that a considerable amount of extemporising, jigging and what not, will be called for; many difficult moments have to be faced and trouble overcome. Sometimes my set-ups had the appearance of a "Heath-Robinson" cartoon. But I can assure my readers that I enjoyed every moment and have no regrets.

The photographs accompanying this article are by J. S. O'Neil, Old Kilpatrick, by Glasgow.

AN EFFECTIVE SOLDER FOR ALUMINIUM

VERY frequently the model engineer requires to solder parts in aluminium, in either its sand-moulded cast state, or the usual drawn or rolled sheet forms. This operation is usually attended by considerable difficulties, since ordinary solders and methods are of little practical use.

In view of the well-known objections, aluminium is usually regarded as non-solderable; but the difficulties can be satisfactorily overcome, with little expense or trouble, by using a solder according to the following composition.

Take three parts of pure zinc and one part of block tin (by weight). The zinc should preferably be taken from a cast ingot of virgin metal, where possible, to ensure purity and cleanliness. Scrap zinc articles should not be melted down for this purpose, since a certain degree of contamination or deterioration cannot be avoided.

The zinc is first melted in an ordinary hand-ladle over a bunsen jet or oxy-acetylene torch, and the tin added. The molten mixture should be gently stirred to ensure a good mix. The ladle should be thoroughly cleaned before using to ensure freedom from contamination by residues or oxides of other metals used previously.

For most effective use the finished solder should be produced in the form of small diameter rods, or thin flat strips. If round rods are preferred, these should be about ¼ in. diameter; whilst the flat strip form should be approximately ⅛ in. thick by ⅜ in. wide.

To reproduce such forms the molten solder is run into simple channels cut in a plaster of paris mould, which may be conveniently contained within a wooden box about 12 in. long.

When applying this solder, much care is required to ensure that the surfaces of the aluminium parts to be jointed are perfectly clean. Both surfaces should be lightly ground immediately before soldering, and should not be fingered after that grinding operation. A clean and *dry* brush should be used to remove grinding particles.

The aluminium articles should be heated and not the rod of solder. The latter should be worked smoothly and gently over the heated surfaces of the parts, and it will quickly begin to run freely, since the solder has a much lower melting-point than the aluminium.

Both jointing surfaces are "tinned" in this manner, and then held together for further heating to bring the deposited solder again to the molten state to complete the joint.

For relatively small parts the soldering may be completed in the above manner without having to use a flux.

Oxidation will be easily avoided, because the aluminium is not raised to a very high temperature; its surfaces will have been thoroughly cleaned by the light grinding, and the soldering will be extremely rapid.

A very strong durable soldered joint can be readily made from this solder, and its use is to be recommended by reason of its simplicity, low cost, and easy application.

—W.M.H.

A ONE INCH SCALE

"Royal Chester"

By E. A. C. LANE

THIS engine was commenced just after the "Model Engineer" Exhibition of 1951. My desire to own one of these fascinating power units was only equalled by my ignorance of them, so that when Mr. Hughes started his articles in THE MODEL ENGINEER, my subject was chosen. Drawings were obtained from THE MODEL ENGINEER offices, and a start was made by scaling down the drawings to 1 in. This was decided upon because I knew that most of it would have to be cut from the solid, and $1\frac{1}{2}$-in. scale would have meant working my M.L.7 to its utmost capacity and possibly shortening its accurate life. Cutting gear wheels is about the most tedius job on the lathe, so a start was made on these. Blanks were turned from mild-steel plate of suitable thickness, and holes were bored in them to suit the mandrels that I possessed at the time. Gears were 24 d.p., cut with an involute cutter mounted in a head held on the toolpost, blank between centres, and the headstock spindle indexed the number of teeth by a worm mechanism mounted at the rear end of the spindle. They were then mounted in bell chuck and the holes opened up with a boring tool, to the correct size necessary to shrink them on their bosses.

Planing the Bevels

The compensating centre was machined from the solid brass and the bevel wheels made and fitted. The bevels were planed by moving the top-slide over to the correct angle, and the teeth planed with a form-tool at approx. 32 d.p. This method is not very accurate, but as the bevels do not move very quickly it was considered that if they were case-hardened they would do. Since then, I have subjected them to strains that the engine would never have to endure, and they are still as fitted, so proving them satisfactory.

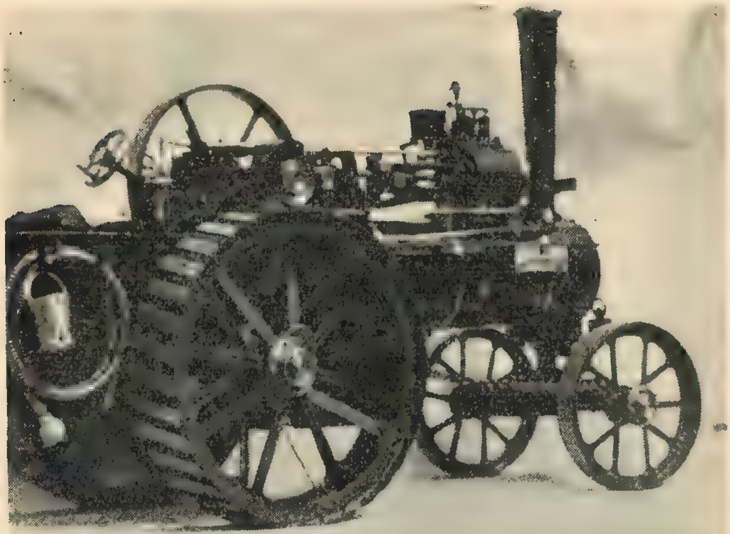
Next came the wheels; someone once said that anybody who could make a pair of hind wheels would be well able to complete the remainder of the engine, and I think that he was not far wrong. I do not possess a drilling machine, so all the rivet holes were put through with a hand-brace. Four pieces of suitable steel tube were obtained for the road wheels, and a cut was taken through each one to true it up. Mild-steel discs were then fitted into the tubes for flanges, two each for hind and one for fore wheels; these were brazed in, leaving a good fillet of brass. As they were only 6 in. in diameter, I was able to fit them to the faceplate, and the rims were then machined all over to the finished size. Before removing wheels from faceplate one of the rivet holes for each of the spokes was marked, by clamping an automatic centre-punch in the toolpost and, by moving the saddle forward, a mark was formed on the flange. The wheel was then indexed round and the operation repeated; a drilling jig was made for the remainder of the holes using the one hole as a register.

The hubs were built up from brass and brazed, and the wheels were made up as described in Mr. Hughes excellent book; spokes are $\frac{1}{16}$-in. mild-steel sheet. The hubs were drilled small at first, and when the wheels were built up they were placed on the faceplate, trued up and then the hubs were bored out to their correct size.

The shafts were next, and these were machined from silver-steel. The splined shaft was interesting; it was planed in the lathe and, using a tool lying on its side in the toolpost, but adjustable in its height to half the thickness of the spline above and below the lathe centre-line, the shaft was indexed slowly round, cuts being taken until only the splines were left in their correct places.

The change gears were slotted and, wonder of wonders, they all went together first time !

Tender came next and was beaten from brass sheet, using wooden formers; it was riveted and soldered



Off-side view of the model " Royal Chester "

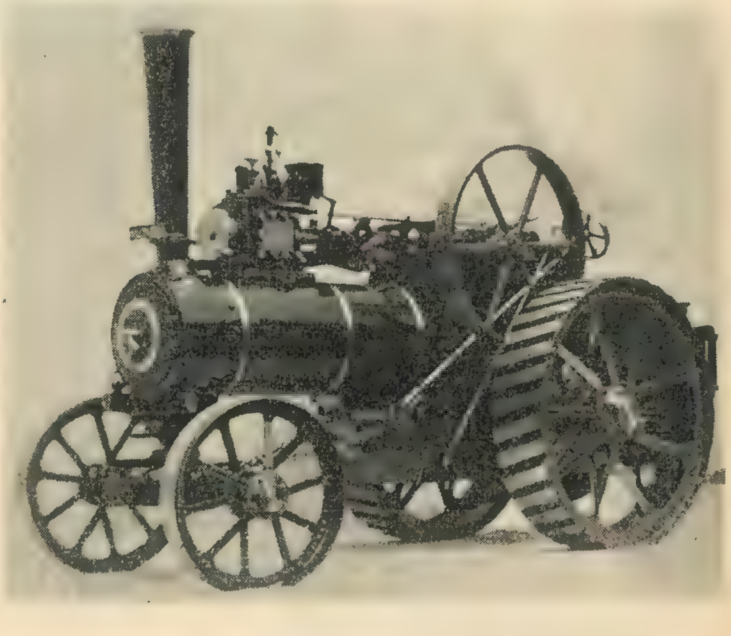
together but was almost a routine job. Hornplates were made from $\frac{1}{16}$-in. mild-steel sheet; they were lightly riveted together and machined. The bearing holes were " jig-bored " on the lathe, using the vertical-slide and a home-made boring head held in the chuck. Bearing bracket and bearings were hacked from solid gunmetal and fitted. Tender draw straps, spectacle plate, front plate, and cross-stay were made and then the lot was put together, gears bedded down and gear change fitted. A period was then spent finishing off what we now had. I had now " sailed off the chart," and I had no further detail to work from and was not sure exactly what to do.

Another visit to the " M.E." Exhibition came next, and after studying those wonderful models I returned home determined to carry on, using the appropriate photographs in Mr. Hughes book. Notes by " L.B.S.C." were studied and sketches were made for a boiler which would fit into the hornplates and be of the correct diameter and length as scaled from the photograph. It was built from sheet copper $\frac{1}{16}$ in. thick, silver-soldered together; it has ten $\frac{3}{8}$-in. tubes and strengthening pieces were fitted inside for fixing the engine. Boiler was tested with water at 150 lb., and hornplates were fitted using hollow screwed stays.

The fore-carriage was next scaled from the photograph and made; the spud-pan was turned from a piece of thick tubing and the dished bottom was brazed into it. The smokebox was turned from tubing and was riveted to the boiler end which enters into the smokebox as a locomotive boiler does, making a strong job. The fore-carriage was fitted, the height being adjusted until the boiler had that slight tip-up from the front. The chimney base was turned from the solid and fitted then the chimney was rolled up from 0.015-in. copper sheet and the cap and flange silvered-soldered on.

The flywheel came next, cut from plate, drilled and filed to shape after being turned to the correct section. The crankshaft came from mild-steel plate also hacksawed out, turned and then filed to give the appearance of being bent up from solid, much easier and more satisfactory than bending up from the bar. I experimented with a couple of pieces of mild-steel rod, but the bends are too short in relation to the journal diameter.

All that was left now was the engine, and after much looking up back numbers of THE MODEL ENGINEER and various drawings, I eventually decided on one design $\frac{3}{4}$-in. bore × $\frac{7}{8}$-in. stroke. Another lump of gunmetal was obtained, and after marking out the outline it was hacksawed roughly to shape, mounted in chuck and the hole for liner bored and steam jacket bored, front faced off, mounted on spigot in reverse and faced off again to correct length. Spigot was next mounted on faceplate and thrown off to the correct distance, allowing the boiler radius to be machined on the saddle. Valve pocket was end-milled out and ports drilled and milled before liner was finally fitted and sweated in. The cylinder-



Near-side view; shows arrangement of the mechanical lubricator

block was then filed to shape and size, one whole Sunday; but the result was worth it, as it looked just right when placed temporaily in position on the boiler.

Trunk guide was turned from solid and brazed to the front cover, the reach rod and valve-gear brackets were silver-soldered on at the same time. The register spigot and the piston-rod hole were turned and bored by mounting the trunk guide or a piece of turned brass in the lathe, thus ensuring that all was in line. This proved satisfactory, as when the crosshead and piston were made and fitted, they worked perfectly.

The cylinder was now bedded on to the boiler, and gave me the sizes of the connecting-rod and eccentric-rods. Stainless-steel came along just then, and so I decided to use as much of it as I could on what should be the bright work. Connecting-rod, eccentric-rods, valve-rod reach-rod and spindle and all the reverse stand with the false front cylinder cover and the steering chains were made from this metal, easy enough to turn but drilling 1/32-in. holes took years off me! The governor only revolves, but the mechanical lubricator of "L.B.S.C." design puts oil into the valve-box well enough.

Water pump is ¼-in. bore and stroke, fitted to right-hand hornplate driven from crankshaft by a rod that has a set in it to miss the second shaft. I decided against an injector but fitted a hand-pump instead; this is placed on the right-hand tender side immediately behind the brake-rod, and it is hidden very well by the hind wheel rim; it is ¼-in. bore by 1-in. stroke. Odd pieces were made to complete the details; foot-board, lamps, bucket and water hose, which was 3/16-in. P.V.C. tubing with fuse wire wound round it; a filter was fitted and it looks very well.

Painting was started; stripping down surprised me with the number of pieces that had been made, each one representing a pleasant period, and I confess to feeling a little sorry that it was now finished. The colour scheme is crimson lake for body and tender, post office red wheels and flywheel, and black for smokebox and fore-carriage, mechanical lubricator, governor, and operating levers. The engine looks very smart and follows the prototype quite closely; it has taken two years of interesting endeavour and I certainly know more about traction engines than I did when first "bitten by the bug." Perhaps, one day, I shall be tempted to try the most exacting of all, a showman's road locomotive in 1½-in. scale.

WITH THE CLUBS

The Society of Model and Experimental Engineers

There will be a "track" meeting on Sunday, September 13th, by courtesy of the Eltham Club, at their continuous track at the Elliot's Sports Ground, Eltham. The event will commence at 11 a.m. If intending visitors will inform the secretary or Mr. Hutton, it will be possible to arrange for tea to be provided. Members should make for New Eltham Station, and follow the Avery Hill Road. Elliott's Sports Ground is about a quarter of a mile from the station on the right-hand side.

In the current programme, the name of the programme secretary was given in error as Col. D. H. Chaddock. This should, of course, have been: Mr. E. T. Bartlett, 1, Heathwood Gardens, Swanley, Kent.

Full particulars of the Society may be obtained from the secretary: E. C. YALDEN, M.C., 31, Longdon Wood, Keston, Kent.

Leicester S.M.E.

The meeting place of the above society will in future be at Belgrave Hall, on Belgrave Road, entrance in Rothley Street, on Wednesday evenings fortnightly, at 7.30 p.m.

The winter programme will consist of lectures, films and visits of interest, together with some model nights.

Hon. Secretary: A. F. ALLSOPP, 25, Dunster Street, Leicester. Telephone 87207.

Wolverhampton Model Engineering Society

At the society's last meeting it was passed unanimously to continue with negotiations for the purchase or lease of the proposed new track site.

The next meeting of the above society will be held at the Mitre Hotel, Church Road, Bradmore, Wolverhampton, adjacent to this site, on Tuesday, September 15th, commencing at 7.30 p.m. Will all members make a special effort to attend so that a further inspection of the site can be made.

Hon. Secretary: C. FARMAN, 99, Canterbury Road, Penn, Wolverhampton.

Kingsmere Model Power Boat Club

Our M.P.B.A. Regatta will be held on Sunday, September 20th, at Brockwell Park, Herne Hill, London, commencing at 11 a.m.

Events will include:

500 yard race for "C" class hydroplanes.

500 yard race for "C" class (restricted) hydroplanes.

500 yard race for "B" class hydroplanes.

500 yard race for "A" class hydroplanes.

Nomination race.

Steering competition.

Hon. Secretary: C. MORGAN, 134, Lavenham Road, Southfields, S.W.18.

Wakefield S. of M. & E.E.

We have had a very satisfactory season with our portable track, despite several rainy days.

Our social visit to the York Society was very much appreciated by all members and gave some of us our first experience of continuous track running.

One very interesting evening was spent recently at a local glass works.

Future meetings in St. Michaels School, Wakefield, at 7.30 p.m.

Sept. 16th. Lecture by Mr. Tait, on "Aero Instruments."

Oct. 7th. Ordinary meeting. Bits and pieces.

Oct. 21st. Talk by Mr. Wood, Leeds.

Sept. 10th, 11th, 12th, we are having a stand at Pontefract Town Hall Handicrafts Exhibition.

Hon. Sec.: J. C. LEA, A.M.I.R.T.E., "Struma," Park Lane, Pontefract.

Stockport and District S. of M.E.

The society continues to extend the facilities available to its members. A tank has recently been installed at our multi-gauge continuous track at Davenport, and is intended for the testing of boat hulls, power plants, and propellers.

On July 18th last a party of our members visited the Manchester Docks. A tour of the various docks and installations was made by motor launch, and we were also able to make an inspection of a new motor ship equipped with Doxford engines.

A visit has been arranged to the Cromford and High Peak Railway, on Saturday, October 3rd. The Derby S.M.E. is co-operating with us on this occasion, and we shall also visit Derby locomotive sheds in the afternoon.

Meetings of the society are held on the first and third Fridays of each month, at 7.30 p.m., in the Foresters' Hall, Churchgate, Stockport. Visitors are always sure of a welcome at any meeting.

Will Mr. H. G. Winton, until recently a member of the society, and now living in the South of England, please communicate with the secretary.

Hon. Secretary: D. MAPP, 163, Mauldeth Road, Withington, Manchester, 20.

THE MODEL ENGINEER DIARY

September 13th.—Blackheath Model Power Boat Club.—Regatta at Princess of Wales Pond, Blackheath, S.E.3.

September 13th, 14th, 15th, 16th, 17th, 18th. — Hastings and District Model Engineers Society.—Exhibition at Lower Hall, White Rock Pavilion, Hastings. Open from 10 a.m. to 9 p.m. daily, except 13th, 3 p.m. to 9 p.m.

September 20th.—Kingsmere Model Power Boat Club.—Regatta at Brockwell Park, Herne Hill, London.

September 23rd, 24th, 25th and 26th. Nottingham Society of Model and Experimental Engineers.—Exhibition at Victoria Baths, 2 p.m. to 9 p.m.; Saturday 10 a.m. to 9 p.m.

September 26th, 27th, 28th, 29th, 30th, October 1st, 2nd, 3rd.—Southport Model and Engineering Club.—Exhibition at Chapel Street Congregational Halls, Southport.

October 1st, 2nd, 3rd.—Hitchin & District Model Engineering Club.—Exhibition in the Town Hall, Hitchin, Herts.

CLASSIFIED ADVERTISEMENTS

WORKSHOP EQUIPMENT

Buck and Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface-plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661. Open 8.30 a.m.-5.0 p.m., Saturday, 1.0 p.m.

"Impetus" machines, wood planers motorised drills, belt sanders, electric motors, paint sprays, air compressors, circular saws, etc. Catalogue.—JOHN STEEL, Castlefields, Bingley.

The New 2½" × 10" "E.W." Lathe can be obtained on the easiest of terms—from £4 4s., deposit and approximately 5s. weekly. Send 2½d. for details. Buy from the specialists. To present users of the "E.W." we can supply any accessory for this machine on terms. Monodex revolving centres, No. 1 or 2 Morse taper shank. Delivered on the first of four payments of 10s. Adept lathes, shapers, Perfecto 5" shaper. No fuss, credit terms. Let us quote you. "Britinol" self blowing spirit lamp, 7s.—WANSTEAD SUPPLY Co., 48, High Street, London, E.11.

Manufacturers' Surplus. 200 new 2½" three-jaw (reversible) scroll chucks (Burnerd) New (slightly soiled) BTM watchmaker's lathe adjustable feet, 8 mm. wire chucks (0.8 to 3.0 mm.), tailstocks and gap beds.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

Plated Nuts, Screws, washers, bolts, soldering tags, shank bushes, self-tapping, screws, grub-screws, socket-screws, wood-screws. Large quantities or gross cartons. Stamp for list.—SINDEN COMPONENTS LTD., Dept. C., 117, Churchfield Road, Acton, W.3. ACOrn 8126.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuilt to limits "Acorntools" and "Atlas" 10" swing s.s. and s.c. lathes. Hire purchase terms are available. Write—610/614, Chiswick High Road, W.4. (Phone: CHI 3416).

G. P. Potts, Ruthin Road, Denbigh. Milling, grinding, saw table attachments, turrets, also castings, drill grinding jigs, collets, B.A. screws, bolts and nuts. Lists 6d.

Wanted. Bench type vertical milling machine, Centac or similar. Heavy compound slide or small milling machine table. Atlas accessories. No rubbish. Price and condition to—THOMPSON, 51, Dewey Road, Dagenham, Essex.

Today's Best Values. The new "Malcar" 4½" lathe, £45. The 8" "Tru-Plane" wood planing machine, £32 10s. H.P. arranged. —WRAGG BROS., Chapel Street, Leabrooks.

Myford ML.7 Lathe wanted, must be in perfect condition.—POUND, 9, Paulhan Road, Kenton, Middx.

Dial Gauges 0.001, 0.0005, 0.0001, for sale at give-away prices. New and second-hand.—J. TAYLOR, 1178, Govan Road, Glasgow, S.W.1.

Powerful, 24 volt, geared motors, series wound. Will run on a.c. or d.c., 24 volt intermittent rating, final speed approx. 75 r.p.m.; weight 3½ lb., size 4⅛" × 2½", approx. ⅛ h.p.; light, powerful and compact. Ideal unit for food-mixers, hedgecutter, etc. Makers Dumore Co., U.S.A. Spur and gunmetal worm-wheel totally enclosed. Price **£1 10s.,** post paid.
H. MIDDLETON,
639, Abbeydale Road, Sheffield, 7.

The Acorn Machine Tool Co. (1936) Ltd., are in a position to undertake the complete rebuilding of Atlas, Acorntools, Sphere and Halifax lathes, or, if preferred, we can supply any spare parts that may be required for these machines. Full range of accessories and equipment for all these machines also available. Generous allowance given on old machines against the supply of new "Acorntool" lathes. Second-hand machines of Atlas and Acorntools manufacture, rebuilt by us, available from £75 each. Write to—610-614, Chiswick High Road, W.4. Tel.: Chiswick 3416-7-8-9.

Myblo 6" Sawbenches, rise and fall spindle, 12" × 9" table, ripp and mitre fences, V-drive; £6 15s. From your tool dealers or direct from makers—P. BLOOD & Co., Arch Street, Rugeley, Staffs.

4" Drummond Lathe extra long round bed, many accessories. Stand and countershaft, £30.—KNIGHTS, 16, Clyde Street, Grimsby.

B. & D. No. 8 Tapper and driller ⅜" Jacob 220, 250 a.c./d.c. B. & D. drill, ¼" Jacob requires rewinding. £5 the two.—4, Tuffley Avenue, Gloucester.

Milnes 5" S.S., S.C. Lathe, 5' gap bed, backshaft with 3-speed self-acting slides, ½ h.p., a.c. motor, countershaft, four chucks and all equipment, excellent condition, £70.—CLARKE, 101, Marple Road, Stockport.

Horizontal Milling Machine. Denbigh floor model, table 20" × 6", excellent condition, £35.—THOMAS, Park Lodge, Bath Road, Stroud.

Shaper 7" stroke all geared, clutch, vice-unused machine, with or without motor, best offer.—48, Staithe Road, Bungay, Suffolk.

For Sale. Pacera linshaft hacksaw machine, very good condition, £12, o.n.o. Buyer collects, enquiries to—55, Chase Court Gardens, Enfield.

MONODEX Regd.

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At last a low-priced efficient "RUNNING HEAD CENTRE" based on an old and well-tried principle is being manufactured and offered to the engineering industry. *This is a precision tool.* No. 2 Morse Taper Shank; Diameter of head 1¼ in.; Overall length 5½ in. Do not be misled by the low *price* **37/6.**
Also available with No. 1 Morse taper at same price. Obtainable at your local tool dealer or sent post paid, on receipt of remittance from **Patentools Ltd., 4, Eaton Gardens, Hove, Sussex.**

Large Quantity of New Arbor Presses manufactured by Jones & Shipman, Model 122, suitable for 12" diameter work, admits arbors 1⅛" dia. To be sold at clearance price of £8 each. For further details please write today to—MODERN MACHINE TOOLS LTD., Maudslay Road, Coventry.

Holtzapffel Ornamental Turning Apparatus for sale. S.A.E. for list.—Box No. 7007, MODEL ENGINEER Offices.

Champion No. 2 Drilling M/C. Complete 1/3 h.p.; 250 V, single-phase, 1,425 r.p.m. motor No. 2 O. & S. Flypress, all in new condition, £20, o.n.o., will separate.—DAVIES, 111, Bulwer Road, London, E.11.

4¼" Relmac S.C. Lathe £14. 4" sliderest treadle lathe, £7. Stringer and Houghton modelmaker's lathes. 3⅜" Mellor B.G., S.C. lathe, £35. 7" cabinet shaper, £32 10s. ½" Capstan lathes, cheap. New ⅛ h.p. 230/1/50 electric motors, £6. New ⅜ h.p. ditto, 920 revs., £9.—KNAPTONS (SMALL MACHINE TOOLS) LTD., 229, Lichfield Road, Birmingham.

For Sale. Myford M.L.7, 3-jaw, independent Burnerd chucks, drill chuck, standard equipment, tools, motorised 1/3 h.p. Perfect condition, £60 or offer.—D. G. BROWN, Larkstone, Newcastle Road, Shavington, Crewe, Ches.

MODELS AND FITTINGS

Craftsmanship Models Ltd., for Westbury "approved" castings. Send s.a.e. for list to—27, Circle Gardens, S.W.19.

Exchange. Marine plant, value £9, for good type steam engine and boiler, or locomotive.—37, Devon Street, Bury, Lancs.

3½" Gauge L.M.S. Locomotive (Doris) to "L.B.S.C." design, brand new, exhibition finished, complete and ready for use. Owner emigrating, £35.—25, Gedeney Road, Tottenham.

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A Cheap 5" or 7¼" Locomotive wanted. —Box No. 6993, MODEL ENGINEER Offices.

Luken's-O'-Birmingham. Live steam specialists. Taliesin 0-4-4-0 narrow gauge double ended locomotive in gauge "O," blueprints, 7s. 6d., wheels 8s. set, frames 2s., cylinders, 17s. 6d. 6d. for list.—10, Coldbath Road, Birmingham, 14.

Destroyer Javelin 44" steam, twin screws, fast. Bargain, £9.—GATES, 60, Beam Avenue, Dagenham.

For Sale. Model locomotive wheels and axles, 4-bogie wheels, 3½" diameter, 4 driving wheels 6¾" diameter, price £4. As new E.D. diesel engine Mark II, fitted with fly-wheel suitable for model boat, £3. ¼ h.p. B.T.H. Fridge motor, £5. Large 12 V dynamo, big output slow speed, voltage control type, £3.—J. W. OLDING, 53, York Road, Northwood Hills.

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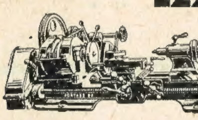

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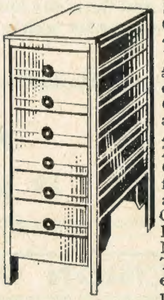

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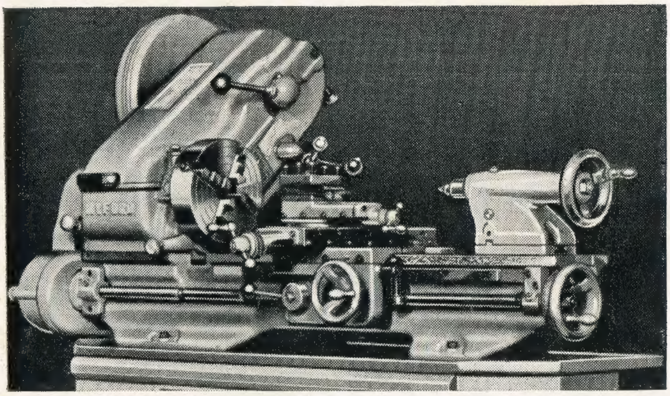

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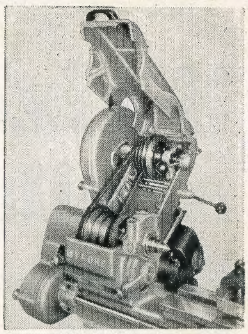

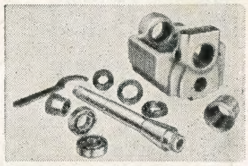

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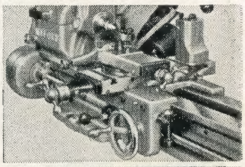

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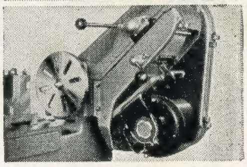

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